Soil Erosion Enhancement Activity – SOE05 – Intensive no-till (ORGANIC or Non-organic systems)

Enhancement Description
This enhancement is for using an intensive no-till, strip till, or direct seeding method of planting throughout the planned rotation. A C:N ratio that builds soil health is maintained by including high residue and low residue crops in the rotation, and/or by using cover crops where needed. Termination of all cover crops is accomplished using chemical methods or non-chemical methods, such as flail mowing, roller crimper, and frost kill; not tillage.

Land Use Applicability
Cropland

Benefits
Use of intensive no-till, strip till, or direct seeding leaves high levels of crop residue that can improve soil health and reduce erosion by wind and water up to 100%. The result is increased soil organic matter and added weed control as compared to heavily tilled soils with no surface residue. This will in turn, enhance and protect water quality and biotic communities that depend on clean water. Mechanically terminating cover crops using a flail mower or roller crimper can eliminate the use of herbicides, thereby reducing potential offsite water quality problems while leaving the soil undisturbed.

Conditions Where Enhancement Applies
This enhancement applies to all acres of annually planted cropland. The acres can be organic, transitioning to organic or non-organic.

Criteria
Implementation of this enhancement **requires** the use of no-till, strip till, or direct seeding of all crops in the planned rotation. The no-till, strip till, or direct seeding system must include the following activities:

1. For each crop in the planned rotation, calculate an estimated post harvest residue amount.
2. Compare the estimated post harvest residue amount to a state and locally defined critical residue amount, as determined by the NRCS State Agronomist, to determine high and low residue-producing crops.

Note: The “defined critical residue amount” is based on maintaining a positive Soil Conditioning Index (SCI).

3. For crops in the rotation where the difference between the estimated and critical residue amount are positive:

   a. No cover crop is required if a Soil Tillage Intensity Rating (STIR) $\leq$ 10 is maintained for the rotation.
   b. Otherwise, cover crops should be:
      i. A single grass species or a multiple species mixture that includes at least 50% grass or legume adapted for the local area, and
      ii. Must be planted using a no-till system.
   c. Residue removal is prohibited (Exception: residue removal is allowed for optimal crop production where SCI can be maintained greater than zero and the criterion of 5(c) is still met).
4. For crops in the rotation where the difference between the estimated and critical residue amount are neutral or negative:
   a. Cover crops must be used
   b. Plant cover crops using a no-till system
   c. Cover crops can be a single grass species or a multiple species mixture that includes at least 50% grass or legume adapted for local use.
   d. Maintain a minimum Soil Tillage Intensity Rating (STIR) $\leq$ 10 for each crop in the planned rotation
   e. Residue removal is prohibited
5. Additional Criteria
   a. All residues must be uniformly distributed over the entire field
   b. No full-width tillage is permitted regardless of the depth of the tillage operation
   c. Field(s) must have a soil loss at or below the soil tolerance (T) level for wind and/or water erosion for the crop rotation and a Soil Tillage Intensity Rating (STIR) of $\leq$ 10 for each crop in the planned rotation
   d. If applicable, only herbicides approved for organic production systems are allowable for weed control
   e. If applicable, termination of all cover crops is accomplished using non-chemical methods, such as flail mowing, roller crimper and frost kill.

Adoption Requirements
This enhancement is considered adopted when the STIR criteria, residue and/or cover crops listed above have been implemented on the land use acreage.

Documentation Requirements
Documentation for each field where this enhancement is applied:
1. Planned crop rotation showing cover crops that will be used after low residue crops,
2. Planting method used for each crop in the rotation (no-till, strip till, direct seeding),
3. List of all other potential ground disturbing farming operations,
4. Method of cover crop termination, e.g. chemical, flail mowing, roller crimper, or combination,
5. Dates for farming operations,
6. Map showing fields and acreage, and
7. Photographs of planted crops.

References

Bolton, R. 2003. Impact of the surface residue layer on decomposition, soil water properties and nitrogen dynamics. M.S. thesis. Univ. of Saskatchewan, Saskatoon, Saskatchewan, CA.

Mutch, D. and T. Martin. 2010. Website: Roller/Crimper Research. Michigan State University. http://www.covercrops.msu.edu/crimper/works.html

Reicosky, D.C., M.J. Lindstrom, T.E. Schumacher, D.E. Lobb and D.D. Malo. 2005. Tillage-induced CO_2 loss across an eroded landscape. Soil Tillage Res. 81:183-194.

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Renard, K.G., G.R. Foster, G.A. Weesies, D.K. McCool, and D.C. Yoder, coordinators. 1997. Predicting soil erosion by water: A guide to conservation planning with the Revised Universal Soil Loss Equation (RUSLE). U.S. Department of Agriculture, Agriculture Handbook No. 703.

Shaffer, M.J., and W.E. Larson (ed.). 1987. Tillage and surface-residue sensitive potential evaporation submodel. *In* NTRM, a soil-crop simulation model for nitrogen, tillage and crop residue management. USDA Conserv. Res. Rep. 34-1. USDA-ARS.

Skidmore, E.L. and N.P. Woodruff. 1968. Wind erosion forces in the United States and their use in predicting soil loss. U.S. Department of Agriculture. Agriculture Handbook No. 346.

USDA-NRCS. 2011. National Agronomy Manual. 190-V. 4th ed.

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For Criteria #1-4; RUSLE2 will be used to determine and document the Soil Condition Index (SCI). To determine which Criteria applies (i.e. Criteria 3 or Criteria 4); a neutral or negative SCI as identified in RUSLE2 shall require a cover crop to be established (i.e. implement criteria 4). If the SCI value is positive, then no cover crop is required (i.e. follow criteria 3).

See Wisconsin Agronomic Technical Note 7 for cover crop recommendations:

ftp://ftp-fc.sc.egov.usda.gov/WI/technotes/agronomy-tn7.pdf

This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

Soil Quality Enhancement Activity – SQL01 – Controlled traffic system

Enhancement Description
Controlled traffic confines heavy traffic from tractor drive wheels/tracks, combine wheels, fertilizer or manure spreaders and grain carts to specific lanes in crop fields year after year.

Land Use Applicability
Cropland

Benefits
Controlled traffic systems will reduce soil compaction, increase infiltration, and improve crop yields. Additional benefits include reductions in erosion, runoff and sedimentation as well as energy savings as the need for sub-soiling decreases and firm traffic tracks form for better traction.

Conditions Where Enhancement Applies
This enhancement applies to all annually planted crop land use acres.

Criteria
Implementation of this enhancement **requires** the use of a *controlled traffic system* on annually planted cropland that includes the following:
1. Limit wheel/track traffic to no more 50 percent of the row middles or a maximum of 50 percent of the area of the field.
2. Wheel/track traffic is in the same lanes for all passes, all equipment and years.
3. No tire or rubber track that is greater than 26 inches wide (for 30-inch rows). For 20-inch or 15-inch rows, use skip rows to provide space for primary tracks (36-inch maximum width tires/tracks for a 40-inch space).

The minimum components required to maintain the controlled traffic system enhancement activity are:
1. All equipment must cover the same width or multiples of that width (See Figure 1),
2. Number of traffic lanes are minimized (See Table 1),
3. For full width tillage Geographic Positioning System (GPS) is required to maintain the designated traffic lanes,
4. For narrow width or drilled crops, a skip row system or GPS is required, and
5. Do not deep till (> 4 inches) the controlled traffic paths.

Adoption Requirements
This enhancement is considered adopted when all three of the criteria above have been implemented on the land use acre.

Documentation Requirements

A description of the controlled traffic system that includes:

1. List of fields with controlled traffic system,
2. Crops rotation for the fields,
3. Equipment used,
4. Row spacing and number of planter units,
5. Planting width for drills,
6. Wheel/track spacing and operational width for tractors, combines, grain carts, harvesters, sprayers, manure spreaders, etc. Tires on planters and drill can be ignored, and
7. Sketch of the traffic paths and wheel/track spacing.

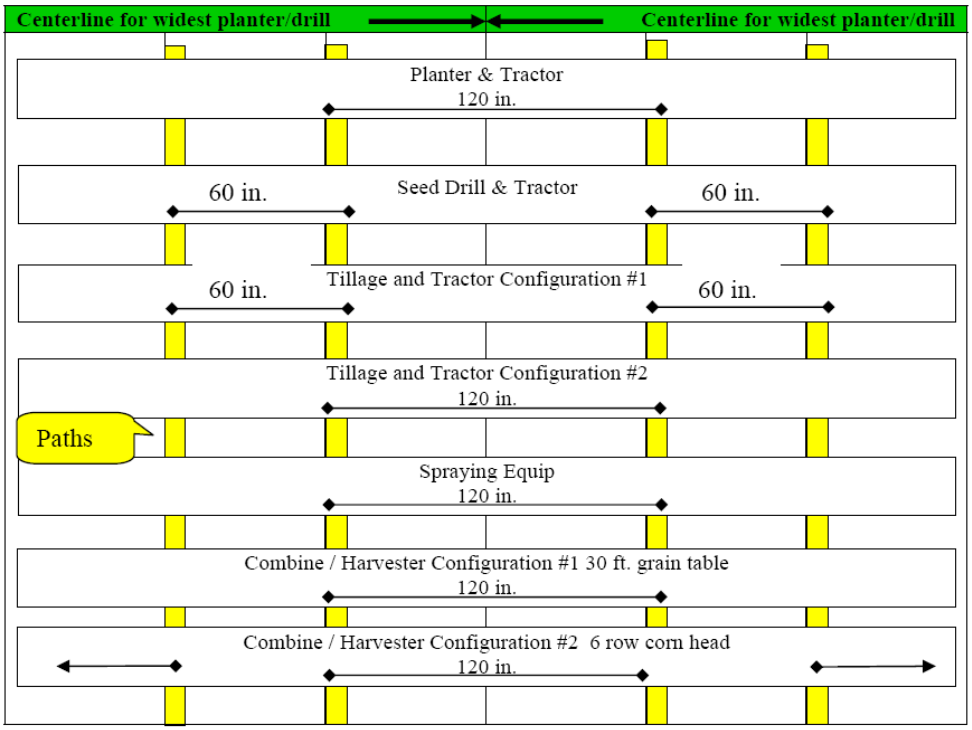

Figure 1. Example of Wheel/Track Spacing and Paths Using Multiples of the Basic Width (units are in inches or number of rows**):**

Situation: 12 row planters with 30 inch rows for corn, 15 foot grain drill, and 6 row corn head on combine, 30 foot grain table on combine, 15 foot tillage tools.

1. If 2 or more tillage operations have the same width and tractor tire configuration the operations are only entered once.
2. If 2 or more combine/harvesting operations have the same width and tire configuration the operation is only entered once.

Note: The 6 row corn head begins by taking the center 6 rows of the 12 row configuration, then harvesting the three outside rows along with 3 outside rows from the adjacent planter pass. This reduces the number of row middles receiving wheel traffic (down to 33% in this example). This applies for any system where the combine is one-half the planter width.

Table 1. Examples of traffic patterns for controlled traffic systems.

Number of rows	Tractor (in)	Combine (in)	Number of paths	% Trafficked Assumes 20" tires
----------30" row spacing----------				
6	60	120	4	44
6	120	120	2	22
8	120	120	2	17
8	60 & 120	120 & 180	6	50
12	60 & 120	120 (6-row)	4	22
16	60 & 120	120 & 180 (8-row)	8	33
24	60 & 120	120& 180 (12-row)	12	33
----------36" row spacing----------				
6	72	144	4	37
8	72	144	4	28
12	72	144	4	18

Note: In the first scenario (line 1), the tractor tire spacing is 60 inches and the combine tire spacing is 120 inches. Each set of six rows has four tire paths. By increasing the tractor tire spacing to match the combine tire spacing, (lines 2 and 3) the number of paths and area trafficked are cut in half.

References

Reeder, R.C. 2002. Controlled traffic. Encyclopedia of Soil Science. Marcell Dekker, Inc. pp233-236.

Reeder, R.C. and J.M. Smith. 2000. Controlled Traffic. In: Conservation Tillage Systems and Management, MWPS-45. Midwest Plan Service, Ames, IA. pp 77-82.

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This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

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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 or cultivars of a single species.

Land Use Applicability
Cropland

Benefits
The use of a cover crop mixture that contains two (2) or more species is often more effective than 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

Conditions Where Enhancement Applies
This enhancement applies to all crop land use acres (excluding permanent hayland).

Criteria
1. Cover crop mixes must contain a minimum of two (2) different plant species or two (2) different cultivars of a single species with differing maturity dates.
2. Cover crop species will be selected from state specific lists. The list of approved cover crops is available at the local NRCS Field Office.
3. Crops planted following cover crop must be no-tilled.
4. Nutrient applications for crops following cover crop should consider nitrogen fixation from leguminous cover crops.

Adoption Requirements
This enhancement is considered adopted when two different plant species or cultivars of a single species are being grown on the land use acre.

Documentation Requirements
1. Written documentation for each year describing, in detail, the following items:
   a. Cover crop species used and dated planted,
   b. Date and amount of fertilizer applied,
   c. Method to kill cover crop and date completed, and
   d. 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.

References

Sainju, U.M., W.F. Whitehead and B.P. Singh. 2005. Biculture Legume–Cereal Cover Crops for Enhanced Biomass Yield and Carbon and Nitrogen. Agron. J. 97:1403–1412.

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See Wisconsin Agronomy Technical Note 7 for cover crop species:

ftp://ftp-fc.sc.egov.usda.gov/WI/technotes/agronomy-tn7.pdf

Record seeding rate and establishment method for each cover crop.

This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

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Soil Quality Enhancement Activity – SQL05 – Use of deep rooted crops to break up soil compaction

Enhancement Description
This enhancement is for the use of deep rooted crops to break up compacted soils and improve soil quality. Deep rooted crops can be perennial plants like alfalfa or annual plants like forage radish.

Land Use Applicability
Cropland

Benefits
Soils can have naturally occurring compacted layers (hard pans) or those that have been created through tillage or other farming activities. Deep rooted crops with large taproots can alleviate the effects of soil compaction by penetrating the compacted layer, creating pore space that allows air, water and crop roots to penetrate deeper in the soil profile. Eliminating soil compaction through the use of deep rooted crops increases infiltration, reduces surface runoff, improves soil tilth and overall soil quality. It also eliminates the need for sub-soiling with a plow, thus saving fuel, reducing erosion and enhancing water quality.

Conditions Where Enhancement Applies
This enhancement applies to all crop land use acres.

Criteria
1. The selected crop must be one that has been identified as having the capability of alleviating soil compaction. State specific lists are available at your local NRCS Field Office.
2. If perennial plants are used and once established, they must be maintained annually by proper fertilization and mowing/harvesting.
3. Annual crops should be seeded early enough in the fall to allow for adequate growth to occur prior to winter. Follow specifications provide by your local NRCS Field Office.
4. No deep tillage is allowed to remove compacted layer.

Adoption Requirements
This enhancement is considered adopted when the selected deep rooted cover crop has been grown in a given rotation on the land use acre.

Documentation Requirements
1. Written documentation for each year describing the following items:
   a. Deep rooted crop(s) used and dated planted.

b. Cash crop planted and method used.
2. A map showing fields where the enhancement is applied.
3. Photographs of a representative number of fields showing deep rooted crops.

References

A. Clark (ed.). 2007. Managing cover crops profitably. 3rd ed. Sustainable Agriculture Network Handbook Series; bk 9.

Magdoff, F. and H. van Es. Cover Crops. 2000. *In* Building soils for better crops. 2nd ed. Sustainable Agriculture Network Handbook Series. National Agriculture Library. Beltsville, MD. pp 87-96.

Sainju, U.M., W.F. Whitehead and B.P. Singh. 2005. Biculture Legume–Cereal Cover Crops for Enhanced Biomass Yield and Carbon and Nitrogen. Agron. J. 97:1403–1412.

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Suitable cover crop species include: Alfalfa, Sorghum Sudangrass, Tillage Radishes and other species with prior approval from NRCS.

Follow Wisconsin NRCS Conservation Practice Standard 340 (Cover Crop) and Wisconsin Agronomy Technical Note 7:

http://efotg.sc.egov.usda.gov/references/public/WI/340.pdf
ftp://ftp-fc.sc.egov.usda.gov/WI/technotes/agronomy-tn7.pdf

Record seeding rate and establishment method for each cover crop.

This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

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Soil Quality Enhancement Activity – SQL08 – Intercropping to improve soil quality and increase biodiversity

Enhancement Description
This enhancement involves the use of intercropping principles (i.e., growing two or more crops in close proximity to each other during part or all of their life cycles) to promote interactions that improve soil and water quality via increased biodiversity and contribute to pest management.

Land Use Applicability
Cropland

Benefits
Incorporating intercropping principles into an agricultural operation increases diversity and interaction between plants, arthropods, mammals, birds and microorganisms resulting in a more stable crop-ecosystem and a more efficient use of space, water, sunlight and nutrients. Furthermore, soil health is benefited by increasing ground coverage with living vegetation which reduces erosion and by increasing the quantity and diversity of root exudates which enhances soil fauna. This collaborative type of crop management mimics nature and is subject to fewer pest outbreaks, improved nutrient cycling and crop nutrient uptake, and increased water infiltration and moisture retention. Soil quality, water quality and wildlife habitat all benefit.

Conditions Where Enhancement Applies
This enhancement applies to all crop land use acres (excluding permanent hayland).

Criteria
One or more of the following intercropping systems shall be used. Systems can be mixed during the contract period allowing for within year diversity on the same field.

1. Relay intercropping – grow two or more crops on the same field with the planting of the second crop after the first one (e.g., over seeding of a clover cover crop into cotton during defoliation; planting of clover at lay by time in corn).
2. Row intercropping – grow two or more crops simultaneously in the same field with at least one crop planted in rows (e.g., planting corn in the rows and interseeding sorghum between the rows, harvesting all as silage; plant vegetables, cereal grains, perennial covers or annual covers between orchard tree rows).
3. Strip intercropping – grow crops in alternate strips wide enough to permit separate crop production machinery, but close enough for crops to interact (e.g., planting alternating strips of corn and soybeans 6 rows each or alternating strips of corn and Sudan grass). Generally, the maximum width of individual strips for effective interaction of crop pests and their

natural enemies is about 30 ft. Note: this criterion is not the same as NRCS Conservation Practice *Stripcropping Code 585*.

Considerations for system design:

1. Adjustments in plant density to avoid overcrowding.
2. Maturity dates and/or development periods to maximize use of nutrients, water and other resources.
3. Combining deep and shallow rooted crops to optimize use of soil moisture and nutrients
4. Utilizing complementary plant structures and crop heights to:
   a. provide support for others to grow (e.g., corn supporting climbing beans),
   b. provide partial shade and a cooler micro-climate for the other (e.g., lettuce and other greens between rows of taller crops),
   c. low-growing living mulch between rows of taller crops to control erosion, reduce soil displacement onto fruit, or suppress weeds.
5. Intercropping a legume with a nitrogen requiring crop to reduce fertilizer N requirements of the system,
6. Adjustments in nutrient application rates to account for nutrients being supplied (e.g., sequestered N from legume sources), recycled or consumed by the components of the intercropping system used,
7. Companion crops that provide food or habitat for natural enemies of key pests of the production crop(s), and
8. Companion crops that serve as alternate hosts of pests of production crops.

Adoption Requirements

This enhancement is considered adopted when one or more of the three listed intercropping systems in the criteria above have been implemented on the crop land use acre where this enhancement applies.

Documentation Requirements

1. Written documentation for each year describing by field:
   a. Intercropping system(s) used
   b. Crops planted
2. A map showing fields where enhancement was applied
3. Photographs of one or more representative number of fields showing the intercropping system(s) used.

References

Zhang, F. and L. Long. 2003. Using competitive and facilitative interactions in intercropping systems enhances crop productivity and nutrient-use efficiency. Plant and Soil. 248, pp 305–312.

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This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

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Soil Quality Enhancement Activity – SQL09 – Conversion of cropped land to grass-based agriculture

Enhancement Description
Conversion of cropped land to grass-based agriculture is the establishment of mixtures of perennial grasses, forbs and legume species on cropland where annually-seeded cash crops have been grown in monocultures. Select perennial species based on species compatibility, forage quality potential, improvements to soil quality, beneficial effects for wildlife and/or production of biomass.

Landuse Applicability
Cropland

Benefits
Perennial plants maintain a living root system throughout the year that provides habitat and organic exudates (food) for soil biota responsible for decomposition and nutrient cycling. Perennials provide soil cover for most of the year and are managed with little or no physical disturbance of the soil. High plant biomass production contributes to increased soil organic matter accumulation. Plant mixtures provide diversity in plant structure, soil cover that moderates soil temperature extremes, rooting depths that improve soil structure and residue quality that stimulates microbial activity. The combination of these factors results in improved soil quality, reduced runoff and erosion and improved water quality.

Many species of birds and animals, including song birds, quail, turkey, pheasants, deer and rabbits, use grasslands as cover and nesting areas, to find food and to rear their young. Managing grassland harvesting techniques can be beneficial to the survival of ground nesting birds and other wildlife species. Altering harvesting patterns can provide escape routes for hens, hens with broods, and hiding fawns. Delaying harvest or leaving portions of a field unharvested can provide nesting habitat. When grassland management and harvesting schedules are planned to alleviate man-made pressures on wildlife, high biomass producing, perennial species can provide desirable habitat for wildlife populations.

Conditions Where Enhancement Applies
This enhancement applies to cropland that is currently in annual crop production. It does not apply to cropland that is currently in a permanent perennial crop such as permanent hay, orchards or vineyards.

Criteria
1. Establish perennial grassland species (e.g., switchgrass, big bluestem, indiangrass, eastern gamagrass, etc.) on cropland according to the NRCS Pasture and Hay Planting (512) conservation practice standard.

2. Minimize soil erosion and disturbance when establishing perennials by using techniques such as no-till planting, use of nurse crops that germinate quickly and/or the use of suitable erosion control practices.
3. Use seeding mixtures of at least three perennial grasses, perennial forbs and/or legumes.
4. Use plant density observations from multiple areas in the field(s) to confirm successful establishment two years from the planting date; compare the actual to the recommended plant density for the seeding mix and region (e.g., at least 10 plants of the seeded mixture per square yard).
5. If the field will be grazed, a grazing management plan that meets CSP eligibility requirements must be developed and followed.

Adoption Requirements

This enhancement is considered adopted on each acre when the annually planted cropland acre has been successfully established to the chosen perennial grass species mix.

Documentation Requirements

1. Provide a map showing the location of the field(s) that were converted from cropland to grassland,
2. List the species that were included in the planting mix for each field,
3. Provide a record of plant density by species (seeded and volunteer; number of plants/sq yd for each species present) for multiple areas in the field(s) prior to harvest each year, and
4. Grazing management plan (as applicable).

References

Jokela, B. and M. Russelle. 2010. Perennial Forages Benefit Soils, Other Crops, & Water Quality. Forage Focus. USDA-ARS. http://www.midwestforage.org/pdf/452.pdf.pdf

Magdoff, F. and H. van Es. Cover Crops. 2000. *In* Building soils for better crops. 2nd ed. Sustainable Agriculture Network Handbook Series. National Agriculture Library. Beltsville, MD. pp 87-96.

Wright, D., J. Marois, M. Vargas and P. Wiatrak. 2003. Perennial Grasses, Soil Organic Matter, And Crop Yield. Proc. of Sod Based Cropping Systems Conference. North Florida Research and Education Center-University of Florida. Quincy, FL.

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In lieu of the Pasture and Hay Planting Standard, refer to the Forage and Biomass Planting Practice Standard (512) or Wisconsin Agronomic Technical Note 5 and/or 6:

http://efotg.sc.egov.usda.gov/references/public/WI/512.pdf
ftp://ftp-fc.sc.egov.usda.gov/WI/technotes/agronomy-tn5.pdf
ftp://ftp-fc.sc.egov.usda.gov/WI/technotes/agronomy-tn6.pdf

This is an 'Actual' type enhancement. Actual type enhancements must be installed in the year(s) scheduled in the contract and maintained for the duration of the contract.

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Soil Quality Enhancement Activity – SQL10 – Crop management system where crop land acres were recently converted from CRP grass/legume cover or similar perennial vegetation

Enhancement Description
Implement a prescriptive crop management system on crop land acres that have been recently converted from CRP grass/legume conservation cover or similar perennial vegetated cover to a rotation of annually planted crops. Note: this enhancement is limited to acres where the conversion event took place not more than 2 years prior (not including hayland).

Land Use Applicability
Cropland (excluding Hayland)

Benefits
CRP grass/legume covered acres or acres with similar perennial vegetated cover that have been recently converted to annually planted crop systems have the potential to lose some or all of the soil health improvements generated from the years of CRP conservation cover. Depending on the new management system being used, the recalcitrant carbon pool in the system could be stable or declining, especially if a form of full width or deep tillage is being used in the new management system. In order to prevent further degradation of the accumulated carbon pool, there is a necessity to implement a crop management system to stabilize or increase these sites as carbon sinks. Utilizing a crop management system on working lands that integrates residue management systems with high residue cover crops will create systems with net carbon inputs and greater conservation benefits than lands that are absent of some degree of residue management.

Conditions Where Enhancement Applies
This enhancement only applies to crop land use acres (excluding hayland) that have been converted from CRP grass/legume conservation cover or acres with similar perennial vegetated cover to a rotation of annually planted crops. Note: this enhancement is limited to acres where the conversion event took place not more than 2 years prior.

Criteria
Develop a crop rotation on the acres where this enhancement applies that implements each of the following components:

1. Sites where burning of any plant materials have occurred during the last year of the CRP contract or since the termination of the CRP contract, are NOT eligible for this enhancement.
2. For each crop rotation, the average annual Soil Tillage Intensity Rating (STIR) as determined by RUSLE2 must be $\leq$ 10,
3. All residues must be uniformly distributed over the entire field,

4. No full-width tillage is permitted regardless of the depth of the tillage operation,
5. Field(s) must have a soil loss at or below the one-half soil tolerance (0.5T) level as determined by approved tools for wind and/or water erosion for the crop rotation, and
6. Between each crop in the rotation, except double cropped situations, seed a high residue cover crop or mixture of high residue cover crops. Each cover crop or mixture shall meet the following requirements:
   a. Seed a cover crop or cover crop mixture at a rate and within a planting date range as determined or agreed to by the NRCS State Agronomist.
   b. Cereal grain cover crops or mixtures shall be top dressed with nitrogen at rates determined or agreed to by the NRCS State Agronomist.
   c. The cover crop or mixture shall reach a maturity level (i.e., growth stage) to ensure 100% soil coverage in the row middles for 3 months of the growing season. For example, cereal rye shall reach the soft dough stage before termination. The NRCS State Agronomist can determine a specified maturity level or desired residue quantity (dry matter basis) for the selected cover crop cultivar.
   d. Termination of all cover crops shall be accomplished by chemical methods, non-chemical methods (such as flail mowing or roller crimper), or a combination of both.

Adoption Requirements

The enhancement is considered adopted when all the criteria above has been fully implemented.

Documentation Requirements

Documentation for each field where this enhancement is applied:

1. Planned crop rotation showing cover crops that will be used after low residue crops,
2. Planting method used for each crop in the rotation (no-till, strip till, direct seeding),
3. List of all other potential ground disturbing farming operations,
4. Method of cover crop termination, e.g. chemical, flail mowing, roller crimper, or combination,
5. Dates for farming operations,
6. Map showing fields and acreage, and
7. Photographs of planted crops.

References

Bolton, R. 2003. Impact of the surface residue layer on decomposition, soil water properties and nitrogen dynamics. M.S. thesis. Univ. of Saskatchewan, Saskatoon, Saskatchewan, CA.

Price, A.J., K.S. Balkcom, L.M. Duzy and J.A. Keltron. 2012. Herbicide and Cover Crop Residue Integration for *Amaranthus* Control in Conservation Agriculture Cotton and Implications for Resistance Management. Weed Technology. In press.

Price, A.J., K.S. Balkcom, R.L. Raper, C.D. Monks, R.M. Barentine, and K.V. Iversen. 2008. Controlling Glyphosate-Resistant Pigweed in Conservation Tillage Cotton Systems. Conservation Systems Research. Special Publication No. 09. USDA-ARS-NSDL, Auburn, AL.

Reicosky, D.C. 2004. Tillage-induced soil properties and chamber mixing effects on gas exchange. Proc. 16th Triennial Conf., Int. Soil Till. Org. (ISTRO).

Reicosky, D.C., M.J. Lindstrom, T.E. Schumacher, D.E. Lobb and D.D. Malo. 2005. Tillage-induced CO_2 loss across an eroded landscape. Soil Tillage Res. 81:183-194.

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Shaffer, M.J., and W.E. Larson (ed.). 1987. Tillage and surface-residue sensitive potential evaporation submodel. *In* NTRM, a soil-crop simulation model for nitrogen, tillage and crop residue management. USDA Conserv. Res. Rep. 34-1. USDA-ARS.

Skidmore, E.L. and N.P. Woodruff. 1968. Wind erosion forces in the United States and their use in predicting soil loss. USDA Agriculture Handbook No. 346.

Sustainable Agriculture Research and Education (SARE). 2010. Managing Cover Crops Profitably. 3rd ed. Handbook #9. College Park, MD.

USDA-NRCS. 2011. National Agronomy Manual. 190-V. 4th ed.

Wisconsin Supplement 4/22/2013

See Wisconsin Agronomy Technical Note 7 for cover crop species and rates:

ftp://ftp-fc.sc.egov.usda.gov/WI/technotes/agronomy-tn7.pdf

Record seeding rate and establishment method for each cover crop.

This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

United States Department of Agriculture
Natural Resources Conservation Service

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Soil Quality Enhancement Activity – SQL11 –Cover cropping in orchards, vineyards and other woody perennial horticultural crops

Enhancement Description
Grow perennial or annual cover crop mixtures of grass, legumes, native flowering plants and/or other forbs year round to provide soil coverage, organic mulch, beneficial insect habitat, and other conservation benefits in orchards, vineyards or other perennial horticultural crops. Cover crops, once planted, are replanted annually or maintained year after year.

Land Use Applicability
Cropland

Benefits
Maintaining orchard and vineyard floors or row middles of perennial horticultural crops with continuous cover protects the soil resource from erosion, enhances soil quality, reduces compaction and rutting from field operations, and suppresses weeds. Cover crops provide habitat for pollinators and natural enemies of crop pests, fix nitrogen (legumes), and conserve moisture via organic mulch and suppress weeds.

Conditions Where Enhancement Applies
This enhancement only applies to acres of orchards, vineyards, and other woody perennial cropping systems.

Criteria
1. Plant cover crops in the inter-row spaces to be compatible with optimum yield and quality of the fruit crop. Grow cover crops on a minimum of 60% of the field area year annually. When annual cover crops are used, plant each succeeding cover crop within as soon as possible after termination of the preceding cover. Residue from the previous cover crop must be left on the soil surface until immediately before the next cover crop is planted.
2. Areas near crop rows or young, establishing trees that must be kept free from competing vegetations shall be maintained with organic mulch to control erosion, conserve soil moisture, and sustain soil quality. Select mulching material, application rate, and placement compatible with needs of the production crop. Total soil coverage (living cover + mulch) shall be maintained at a minimum of 85% of the field area. Replenish mulch as needed. Exception: In lieu of using mulch to meet the 85% minimum requirement, the area beyond the 60% minimum shall be seeded to a cover crop for systems where the mulching material would hinder harvest operations.
3. Select and seed cover crop mixtures at rates and within planting date ranges as determined or agreed to by the NRCS State Agronomist. Perennial mixtures must consist of at least two

species from different plant families. Annual cover crops must include at least three species from a minimum of two different plant families.

4. Select a mixtures and sequence of cover crop species to accomplish two or more of the following objectives:
   a. High biomass and root mass to build soil organic matter. Expect at least 2 tons/ac of aboveground biomass annually.
   b. Biologically fixed nitrogen for the production crop. Choose a mixture that will provide sufficient but not excessive amounts of N to the crop. Schedule mowing or termination of the cover to optimize rate and timing of N release for crop needs. Leave clippings near crop rows for desired N delivery.
   c. Mulch generation. Plant mixtures which can be cut periodically to generate mulch material for application to crop rows or areas not protected by living cover.
   d. Weed suppression. Select covers that establish rapidly form a heavy canopy and suppress weeds without competing excessively with the production crop. Schedule mowing of perennial covers to optimize weed control and prevent weed propagation.
   e. Habitat for beneficial insects. Select a mixture of flowering plants based on the habitat needs of key predators or parasitoids to control the most economically important pests of the crop to be protected.
   f. Pollinator habitat. Select a mixture of flowering plants to provide food and habitat for desired pollinators. Time mowing and other management operations to minimize competition for pollinators while the fruit crop is blooming.

Adoption Requirements

This enhancement is considered adopted when cover crop mixture are established and total ground coverage (living cover + organic mulch) reaches 85% of the field area.

Documentation Requirements

1. Cover crop species mix, planting dates, mowing dates and (for annual species) termination dates and methods.
2. Pattern and layout of production and cover crops plus mulch used to document how soil coverage criteria were reached.
3. The accomplished items from “Criteria #4.”
4. Photographs of representative fields showing cover crops added to the rotation, timing and method of cover crop establishment, and cover crop management.
5. Seed and legume inoculant tags and receipts.

References

Ames, G. K., G. Kuepper, and A. Baier. 2004. Tree Fruits: Organic Production Overview. National Sustainable Agriculture Information Service. http://attra.ncat.org.

Dufour, R. 2006. Grapes: Organic Production. National Sustainable Agriculture Information Service. pp 44. http://attra.ncat.org

Hinman, T., and G. Ames. 2001. Apples: Organic Production Guide. National Sustainable Agriculture Information Service. pp 40. http://attra.ncat.org

Kuepper, G. L., S. Diver, K. Adam, M. Guerena, and P. Sullivan. 2004. Blueberries: Organic Production. National Sustainable Agriculture Information Service. pp 26. http://attra.ncat.org

Kuepper, G.L., H. Born, and J. Bachman. 2003. Organic Culture of Bramble Fruits. National Sustainable Agriculture Information Service. pp 20. http://attra.ncat.org

USDA Sustainable Agriculture Research and Education (SARE) Handbook Series Book 9. Managing Cover Crops Profitably, 3rd Ed. http://www.sare.org.

Wisconsin Supplement 4/22/2013

See Wisconsin Agronomy Technical Note 7 for cover crop species and rates:

ftp://ftp-fc.sc.egov.usda.gov/WI/technotes/agronomy-tn7.pdf

Record seeding rate and establishment method for each cover crop.

This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

United States Department of Agriculture
Natural Resources Conservation Service

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Soil Quality Enhancement Activity – SQL12 – Intensive cover cropping in annual crops

Enhancement Description
Grow and manage *seasonal* cover crops of grasses, legumes or forbs to maintain soil coverage and other conservation benefits during all the non-crop production periods in an annual crop rotation. Intensive cover cropping is applicable to conventional, specialty and organic crop production systems.

Landuse Applicability
Cropland

Benefits
Using seasonal cover crops during all non-production periods between annually produced crops reduces wind and water erosion. When managed appropriately for local conditions, cover crops can restore and maintain soil productivity and soil quality over a wide range of climates and crop species. Cover crops restore and maintain soil properties by increasing organic matter, relieving compaction, improving soil tilth and fertility, fixing nitrogen (legumes), recycling nutrients in the soil profile, breaking pest cycles and providing habitat for soil biota, such as beneficial bacteria, mycorrhizal fungi and earthworms.

Conditions Where Enhancement Applies
This enhancement applies to all acres of annually planted cropland. These acres can be organic, transitioning to organic, or non-organic.

Criteria
Implementation of this enhancement requires the use of cover crops to provide soil coverage during the non-crop production periods of the rotation. To minimize periods of soil exposure, plant cover crops as soon as practical after harvest of each production crop. Use cover crop species appropriate to the season and seeding as well as seeding rates and methods that will yield a uniform stand and rapid ground coverage. Cover crops may be seeded into standing production crops provided seeding rates and methods, soil moisture levels and other environmental conditions are adequate to yield a satisfactory cover crop stand.

For the purposes of this enhancement, the cover crop shall not be harvested or grazed.

Each cover crop in the rotation shall meet the criteria for a least one of the following purposes. Over the duration of the crop rotation, cover crops shall be utilized to meet two or more of the criteria.

1. High bio-mass cover crops for erosion control and increased soil organic matter improvement.

   a. Plant a cover crop with a growth potential to produce a minimum of 3,000 lbs/acre (dry weight) above ground bio-mass when terminated by seasonal temperature changes (frost or heat), mechanical action (mowing, tillage, crimping, etc.) and/or herbicides in preparation for the following crop. Use seeding rates and row spacing (for drilled cover crop) that will provide rapid canopy closure and adequate ground coverage to prevent erosion between production crops, with a minimum of 90% cover by the time of cover crop termination.
   b. Leave the entire biomass in the field (i.e., do not harvest or graze the cover crop)
   c. Growth potential lists and recommended seeding rates and methods for selected cover crops are available in "Managing Cover Crops Profitably, 3rd Edition" (Clark, 2007).
2. Legume cover crops for biological nitrogen fixation.
   a. Plant a leguminous cover crop between two primary crops in the rotation. This option does not apply to legumes that are normally part of the crop rotation. The legume shall be seeded at a rate recommended by the NRCS Field Office Technical Guide. Estimate nitrogen credits from the leguminous crop and base any additional N applications according to the guidelines of the Land Grant University, as approved by the NRCS State Agronomist.
   b. Manage legume N to minimize N loss. In climates and soils where rapid N mineralization and/or leaching are likely, plant a legume-grass mixture to increase the biomass C: N ratio. This will decrease the N release rate.
3. Non-leguminous cover crops to capture and recycle residual nitrogen.
   a. Plant a cover crop with a growth rate and rooting depth sufficient to scavenge excess/unused nitrogen remaining in the upper soil profile. Select cover crops, planting dates and seeding rates as determined or agreed to by the NRCS State Agronomist.
   b. Consider reducing the N recommendation for the following crop by an estimated amount based on the site conditions both before and during the cover crop's growing period, the cover crop species, and the termination phase of the cover crop.

   Note: This option does not apply to the same acres on which a leguminous cover crop is applied.
4. Cover crops for weed suppression.
   a. Plant a cover crop with the chemical and physical characteristics necessary to suppress or compete with the identified target weed species. Leave cover crop residues on the soil surface to maximize the allelopathic (chemical) and mulching (physical) effects. Select cover crops, planting dates and seeding rates as determined or agreed to by the NRCS State Agronomist.
5. Biodiversity improvement with cover crops.
   a. Plant cover crop species with the characteristics to attract beneficial insects such as pollinators and/or predator insects, serve as trap crops for damaging insects, and/or provide natural bio-fumigation for soil dwelling pests. Select cover crops, planting dates and seeding rates as determined or agreed to by the NRCS State Agronomist.

Adoption Requirements

This enhancement is considered adopted when two or more of the criteria are met on land use acreage.

Documentation Requirements

1. Crop rotation records, including rotation length in years, crops and cover crops planted,
2. Sequence and description of operations for each crop and cover crop including harvest, tillage, nutrient placement and planting/seeding,
3. Photographs of representative fields showing cover crops added to the rotation, timing and method of cover crop establishment, and extent of cover crop growth just before termination, and
4. Seed and legume inoculant tags and receipts.

References

A. Clark (ed.). 2007. Managing cover crops profitably. 3rd ed. Sustainable Agriculture Network Handbook Series; bk 9.

Magdoff, F. and H. van Es. Cover Crops. 2000. *In* Building soils for better crops. 2nd ed. Sustainable Agriculture Network Handbook Series. National Agriculture Library. Beltsville, MD. pp 87-96.

Wisconsin Supplement 4/22/2013

See Wisconsin Agronomy Technical Note 7 for cover crop species and rates:

ftp://ftp-fc.sc.egov.usda.gov/WI/technotes/agronomy-tn7.pdf

Record seeding rate and establishment method for each cover crop.

This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

United States Department of Agriculture
Natural Resources Conservation Service

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Water Quality Enhancement Activity – WQL01 – Biological suppression and other non-chemical techniques to manage brush, herbaceous weeds and invasive species

Enhancement Description
This enhancement is for the reduction of woody brush, herbaceous weeds and invasive plants using non-chemical methods. Physical methods include pulling, hoeing, mowing, mulching or other similar techniques. Biological methods include use of natural enemies either introduced or augmented. Use of chemicals is prohibited with this enhancement.

Land Use Applicability
Pastureland, Rangeland, Forestland

Benefits
Environmental benefits will be site specific. Benefits may include but are not limited to improved water quality achieved through eliminating the use of synthetic pesticides resulting in no chemicals in surface runoff or leaching into the soil profile. Air quality will see similar impacts by eliminating chemical drift and volatilization. Controlling invasive species, brush and weeds will allow native plant communities to return and improve wildlife habitat.

Conditions Where Enhancement Applies
This enhancement applies to all pasture, range or forest land use acres.

Criteria
1. Develop a plan for managing invasive plants, brush and/or weeds that includes:
   a. Assessment of existing conditions,
   b. Identify strategies for control,
   c. Control methods selected,
   d. Monitoring and evaluation process, and
   e. Operation and maintenance follow up activities.
2. Implementation of this enhancement requires the use of biological and/or physical pest suppression techniques instead of pesticides. These techniques, used individually or in combination, can include activities such as:
   a. Grazing animals (primarily through the use of goats) to target undesirable vegetation.
   b. Introduction of beneficial insects to attack undesirable vegetation.
   c. Introduction of beneficial micro-organisms to attack undesirable vegetation.
   d. Prescribed burning
   e. Hand removal or cultivation

   f. Mowing or cutting
   g. Use of heavy equipment in areas with well established, dense brush cover
3. Biological suppression techniques should be based on techniques recommended by the local Land Grant University.
4. Biological suppression must be preceded by an analysis to ensure the proposed biological agent is compatible with the agronomic, ecological and social objectives of the operation.
5. Operation and maintenance activities must be followed to ensure regrowth or resprouting is controlled. Additional treatment of individual plants or areas needing retreatment should be completed as required to effectively controlling the targeted species.

Adoption Requirements

This enhancement is considered adopted when invasives are being managed via biological or physical methods described above and no pesticides were used.

Documentation Requirements

Written documentation for each treatment area and year of this enhancement including:

1. A full description of all biological and/or physical suppression techniques utilized include:
   a. Method (s) of control used
   b. Area (s) on farm control methods were applied
   c. Number of animals or insect colonies distributed and the planned time frame of the treatment.
   d. Photograph (s) of treatment applied
2. A map showing where the activities were applied including treatment acreage

References

Bellows, T.S., and T.W. Fisher. 1999. Handbook of Biological Control. Academic Press.

Bond, W. and A.C. Grundy. 2001. Non-chemical Weed Management in Organic Farming Systems. Weed Research 41: 383-405.

DiTomaso, J.M., M.L. Brooks, E.B. Allen, R. Minnich, P.M. Rice, and G.B. Kyser. 2006. Control of Invasive Weeds with Prescribed Burning. Weed Technology 20(2):535-548.

Peischel, A. and D.D. Henry, Jr. 2006. Targeted Grazing: a Natural Approach to Vegetation Management and Landscape Enhancement. American Sheep Industry.

Popay, I., and R. Field, 1996. Grazing Animals as Weed Control Agents. Weed Technology 10(1):217-231.

Upadhyaya, M.K., and R.E. Blackshaw. 2007. Non-Chemical Weed Management : Principals, Concepts and Technology. Cabi.

USDA-NRCS. 2010. Conservation Practice Standards: Herbaceous Weed Control-Code 315, Integrated Pest Management-Code 595, and Prescribed Burning-Code338.

USDA-NRCS. 2009. Conservation Practice Standard: Brush Management-Code 314.

Valentine, J.R., 1989. Range Developments and Improvements, 3rd ed. Academic Press, MA.

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Document the target species, method of suppression, and timing and location of treatments.

Criteria 2a, 2b, 2c (if selected) must be evaluated and approved by the NRCS Area Resource Conservationist prior to implementation. Federal and/or state permits may also be required for Criteria 2b and 2c.

This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

United States Department of Agriculture
Natural Resources Conservation Service

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Water Quality Enhancement Activity – WQL03 – Rotation of supplement and feeding areas

Enhancement Description
The proper location and regular movement of livestock concentration areas such as feeding areas and mineral blocks in a manner that will improve livestock distribution, reduce localized areas of disturbances and reduce impacts on water bodies.

Land Use Applicability
Pastureland, Rangeland, Forestland

Benefits
The benefits of proper location and rotation of supplement and feeding areas are:
1. Aid in livestock distribution and utilization of forage
2. Reduce compaction of the soil and excess trampling of vegetation
3. Reduce high concentrations of nutrients around water sources for improved nutrient distribution in the grazed area.
4. Improve animal health (concentrated areas of parasites etc.)
5. Reduced energy consumption (where heavy use area will be decommissioned)

Conditions Where Enhancement Applies
This enhancement applies to all grazing acres in the operation for the selected land use.

Criteria
1. Move all supplement sources (i.e., salt or mineral block, tub or station) locations between grazing periods or every 30 days during a grazing period.
2. Move all feeding locations (including creep feeders) every 30 days or less.
3. Locate supplement sources at least ¼ mile (1,320 ft) from surface water and watering facilities. In those situations where pasture size limits supplement source placement or multiple water sources preclude meeting the minimum distance requirement, move supplement areas twice as frequent as described in criteria 1 or 2 to prevent nutrient buildup and to maintain good ground cover.
4. Follow a written grazing plan that meets NRCS requirements.

Adoption Requirements

This enhancement is considered adopted when supplement source locations and feeding areas are being moved at intervals less than or equal to this job sheet's criteria and the locations are at distances from surface water greater than or equal to the suggested criteria of this job sheet.

Documentation Requirements

1. A map showing the location of supplement sources and feeding areas in each pasture, and
2. The schedule for moving the supplement source and feeding area locations.

References

Alberta Cattle Commission. 2005. Cattle Wintering Sites – Managing for Good Stewardship. Prairie Farm Rehabilitation Administration, Alberta Agriculture, Food and Rural Development, and the Alberta Environmentally Sustainable Agriculture Program. E-publication, Government of Alberta.

Ball, D.M., C.S. Hoveland and G.D. Lacefield. 2007. Southern Forages – Chapter 25, 4th ed. International Plant Nutrition Institute, Norcross, GA.

Holechek, J. L., R. D. Pieper and C. H. Herbel. 2000. Range Management Principals and Practices – Chapter 10. 5th ed. Prentice Hall, NJ

USDA-NRCS. 2010. Conservation Practice Standard: Prescribed Grazing-Code 528.

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Documentation will include map or photo of supplemental feeding area, type of feed used, number of animals, and duration of feeding at each site.

This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

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Water Quality Enhancement Activity – WQL04 – Plant tissue tests and analysis to improve nitrogen management

Enhancement Description
Use plant tissue tests to adjust nitrogen application rates.

Land Use Applicability
Cropland

Benefits
The use of either plant tissue testing or leaf tissue testing is an adaptive nitrogen management technique used to adjust nitrogen application rates in-season (leaf tissue test) or for the following crop year (stalk test). Test such as these help provide a thorough analysis of how nitrogen is being used by the current crop, giving a basis for adjustments to nitrogen rates. The end result is a more complete utilization of the nitrogen applied and less nitrogen remaining in the soil to be lost to the environment through nitrate leaching or soil emissions of nitrous oxide.

Conditions Where Enhancement Applies
This enhancement applies to all crop land use acres.

Criteria
This enhancement requires the use of an analysis of appropriate plant tissue to monitor the uptake of nitrogen and other nutrients during the growing season or for the following year and to make necessary adjustments in nutrient applications.

In-season tissue testing and analysis

1. This enhancement is limited to crops and state's with one or more of the following:
   a. A Land Grant University (LGU) that provide tissue analyses,
   b. That recognize private commercial laboratory analyses,
   c. Where chlorophyll tissue testing is a recognized methodology, or
   d. Where aerial imagery (infrared) technology is a recognized methodology.
2. Participant must have a current soil test (no more than 3 years old).
3. Nutrient application rates are within the LGU recommendations based on soil testing and established yield goals and considering all nutrient sources.
4. Follow guidelines from the laboratory and local LGU for interpretation of the results and appropriate adjustments in the application of N and other nutrients.

Plant tissue testing and analysis for the following year
Corn stalk testing and analysis - The nitrogen status of the corn crop can be determined by measuring the nitrate concentrations in the lower portions of cornstalks at the end of the growing season. This involves taking an 8" sample of the cornstalk after black layer

development in corn. The stalk is analyzed for nitrate to determine if the corn received insufficient, sufficient, or excessive levels of nitrogen. Since this test is conducted after the current corn crop is mature, the results are used to "fine-tune" nitrogen recommendations in the next corn crop. Follow your LGU guidelines for the use of this type of test.

Adoption Requirements

This enhancement is considered adopted when the results from plant tissue testing have been used to make nutrient application adjustments, either in-season or for the next crop year.

Documentation Requirements

Each year, documentation for each treatment area (field) shall describe the following essential items:

1. A map showing where the activities are applied,
2. Test used (stalk, leaf, chlorophyll, infrared, or other plant tissue),
3. Dates of test(s),
4. Acres for each treatment area,
5. Soil test results for each treatment area,
6. Manure analysis results (if applicable),
7. Crop yields (both yield goals and measured yield, if available),
8. Amounts of all nutrients applied in each treatment area,
9. Plant tissue test results (including reference strips), and
10. Change in annual N applied due to adaptive management change per treatment area.

Note: In lieu of documenting each individual item listed in the Documentation Requirements, a Certified Crop Advisor plan that contains each of the items may be substituted.

References

Blackmer, A.M. and A.P. Mallarino. 1996. Cornstalk Testing to Evaluate Nitrogen Management (PM-1584). Iowa State Univ. Extension.

Brouder, S. and D. Mengel. 2003. The Pre-sidedress Soil Nitrate Test for Improving N Management in Corn (AY-314-W). Purdue Univ. Extension.

International Plant Nutrition Institute (IPNI). 2012. 4R Plant Nutrition – A Manual for Improving the Management of Plant Nutrition (North American Version). IPNI, Norcross, GA.

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In-season tissue testing and analysis and/or **Plant tissue testing and analysis for the following crop** shall apply to: Vegetable, Fruit, and all Non-Legume crops (ex. corn, potato, tobacco, etc.) where nitrogen is applied.

In-season tissue testing and analysis:

In-season plant tissue analysis shall apply to the crops listed in:
Wisconsin Extension Publication A2289 "Sampling for Plant Analysis".
This publication provides guidance for sampling protocol specific to the crop, stage of growth, plant part to sample, number of plants or parts, and preparations of samples for shipping.

http://douglas.uwex.edu/files/2010/05/Plant-AnalysisSampling.doc

One sample shall not represent more than 20 acres.

Corn stalk testing and analysis:

For Corn Stalk sampling instructions see:
"Considerations when using the end-of-season corn stalk nitrate test", Wisconsin Crop Manager 17(26):113-114
http://fyi.uwex.edu/grain/files/2010/10/stalk-nitrate-test.pdf

For additional reference information see "Cornstalk testing to evaluate nitrogen mannagement", Iowa State University, University Extension PM1584.
http://www.extension.iastate.edu/Publications/PM1584.pdf

Submit collected samples to UW Soil & Plant Analysis Lab or other accredited lab.

To perform the stalk tissue test for corn silage, leave small sample area locations unharvested until black layer development.

One sample shall not represent more than 20 acres.

This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

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Water Quality Enhancement Activity – WQL05 – Apply nutrients no more than 30 days prior to planned planting date

Enhancement Description
This enhancement is for applying nutrients from fertilizer, manures and/or compost no more than 30 days prior to the planned planting date of the crop.

Land Use Applicability
Cropland

Benefits
Nutrient application timing is critical in order for nutrients to be available during critical crop growth stages and to meet crop yield goals. Nutrients that are land applied in excess of 30 days prior to the planned crop planting date are potentially lost to the environment causing water quality concerns and potential soil emissions of nitrous oxide, a potent greenhouse gas.

Conditions Where Enhancement Applies
This enhancement applies to only annually planted crop land use acres.

Criteria
Implementation of this enhancement requires:
1. Fertilizer, manure or any other organic by-products, regardless of form or application method must be applied no more than 30 days prior to the planned crop planting date, or after crop planting.
   a. Utilized incorporation or injection where recommended by the Land Grant University (LGU)
2. The producer must have a current soil test (no more than 3 years old).
3. Nutrient application rates must be within the LGU recommendations based on soil testing and established yield goals and considering all nutrient sources.
4. Soil surface disturbance must be minimized by nutrient applications to stay within the site's residue management goals.

Adoption Requirements
This enhancement is considered adopted when all four criteria above have been met on the land use acre.

Documentation Requirements
For each year of this enhancement, provide documentation of the following:
1. A map showing the treated acres,

2. Target (planned) crop,
3. Planned planting date,
4. Actual planting date and crop planted,
5. Soil test results,
6. Manure analysis results (where appropriate),
7. Crop yields (both yield goals and measured yield), and
8. Nutrient application rates/amounts and application dates for each treatment area.

Note: In lieu of documenting each individual item listed in the Documentation Requirements, a Certified Crop Advisor plan that contains each of the items may be substituted.

References

Follett, R.F. 2001. Nitrogen Transformation and Transport Processes. pp. 17-44, In R.F. Follett and J. Hatfield. (eds.). 2001. Nitrogen in the Environment; Sources, Problems, and Solutions. Elsevier Science Publishers. The Netherlands. 520 pp.

Stevenson, F.J. (ed.) 1982. Nitrogen in Agricultural Soils. Agron. Series 22. ASA, CSSA, and SSSA, Madison, WI.

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This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

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Water Quality Enhancement Activity – WQL07 – Split nitrogen applications, 50% after crop emergence or pasture green up

Enhancement Description
Apply no more than 50% of total crop nitrogen needs within 30 days prior to planting or in the case of pasture or hay after green up of the dormant grasses. Apply the remaining 50% or more of the total nitrogen needs after crop emergence or pasture green up.

Land Use Applicability
Cropland, Pastureland

Benefits
Timing of nitrogen application can be used to ensure adequate amounts of N are available during critical growth stages. Application rates can also be adjusted based on crop forage conditions to refine yield goals. Split application of 50% or more of the total N needs allows for more efficient nutrient utilization resulting in a reduced potential for N loss through leaching and/or greenhouse gases to the environment (e.g. nitrous oxide).

Conditions Where Enhancement Applies
This enhancement applies to all crop or pasture land use acres.

Criteria
Implementation of this enhancement requires:
1. Regardless of form or application method (fertilizer, manure or any other organic byproducts), apply no more than 50% of crop N needs within 30 days prior to planting and 50% or more of the N needs after crop emergence or in the case of pasture or hay after green up of the dormant grasses.
2. Post emergence N application rates can be reduced based on crop scouting reports that would suggest lower yield potential. Scouting reports shall be provided.
3. Participant must have annual manure analysis (if organic nutrient sources are used)
4. Nutrient application rates must be within the "Land Grant University (LGU) recommendations based on soil testing and established yield goals and considering all nutrient sources.
5. Minimize soil surface disturbance to stay within the site's residue management goals.

Adoption Requirements
This enhancement is considered adopted when all of the relevant criteria above have been implemented on the land use acre.

Documentation Requirements

1. Written documentation for each treatment area (field) and year of this enhancement describing these items:
   a. Acres,
   b. Planned crop,
   c. Planting date and crop planted,
   d. Dates of crop emergence,
   e. Annual manure analysis results (if organic nutrient sources are used),
   f. Crop yields (both yield goals and measured yield),
   g. Nutrient application rates/amounts and application dates for each treatment area, and
   h. Scouting reports.
2. A map showing where the activities are applied.

Note: In lieu of documenting each individual item listed in the Documentation Requirements, a Certified Crop Advisor plan that contains each of the items may be substituted.

References

Follett, R.F. 2001. Nitrogen transformation and transport processes. *In* Nitrogen in the environment; sources, problems, and solutions, (eds.) R.F. Follett and J. Hatfield, pp. 17-44.

International Plant Nutrition Institute (IPNI). 2012. 4R Plant Nutrition – A Manual for Improving the Management of Plant Nutrition (North American Version). IPNI, Norcross, GA.

Randall, G., J.A. Delgado, J.S. Schepers. 2008. Nitrogen management to protect water resources. p. 911-945. In Schepers and Raun (eds) Nitrogen in Agricultural Systems. SSSA Monograph. 49. Madison, WI.

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This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

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Water Quality Enhancement Activity – WQL09 – Apply phosphorus fertilizer below the soil surface

Enhancement Description
This enhancement is for the application of all phosphorus fertilizer at least 3 inches deep, including manure, or as a 2X2 row starter. Note: the use of this enhancement may require a revised Highly Erodible Land Conservation (HELC) plan.

Land Use Applicability
Cropland

Benefits
Nutrient management encompasses managing the amount, source, placement, form, and timing of the application of plant nutrients and soil amendments. Nutrient management effectively utilizes available nutrient resources to supply crops with nutrients required to efficiently produce food, forage, fiber, and cover while minimizing environmental degradation. Nutrient management enhancement activities help agricultural production and the environment.

Increased management activities will protect and enhance water quality and the biotic community that depends upon clean lakes and rivers. Nutrient application placement is critical in order for nutrients to be available during critical crop growth stages and to meet crop yield goals. By applying phosphorus either 3 inches deep or as a 2x2 row starter, it is less vulnerable to loss in surface runoff, both in solution and attached to soil particles, therefore reducing the potential loss of nutrients to the environment.

Conditions Where Enhancement Applies
This enhancement applies to all annually planted crop land use acres.

Criteria
Implementation of this enhancement requires:
1. All phosphorus fertilizer, regardless of form, will be injected at least 3 inches deep below the soil surface, and/or phosphorus applied as a starter fertilizer during the planting operation will be placed in a band 2 inches to the side and 2 inches below the crop seed (commonly referred to as"2x2" placement).
2. Producer must have a current soil test (no more than 3 years old)
3. The amount of phosphorus fertilizer applied as a starter in the 2x2 placement shall not exceed the rate recommended by the Land Grant University (LGU).
4. The total amount of phosphorus applied shall not exceed the rate recommended by the "Land Grant University" (LGU) based on soil testing and established yield goals.
5. Soil surface disturbance must be minimized during phosphorus injection.

Adoption Requirements

This enhancement is considered adopted when all phosphorus is subsurface applied as either a 2X2 starter application or ≥ 3 inches below the soil surface.

Documentation Requirements

1. Documentation for each treatment area (field) and year of this enhancement describing the following:
   a. Treatment acres,
   b. Target (planned) crop,
   c. Soil test results,
   d. Crop yields (both yield goals and measured yield),
   e. Phosphorus application rates/amounts and application dates for each treatment area, and
   f. Method used to inject or incorporate phosphorus.
2. A map showing where the activities are applied.

Note: In lieu of documenting each individual item listed in the Documentation Requirements, a Certified Crop Advisor plan that contains each of the items may be substituted.

References

Sims, J.T. (ed.) 2005. Phosphorus: Agriculture and the Environment. Agronomy Monograph 46. ASA, CSSA, and SSSA, Madison, WI.

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This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

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Water Quality Enhancement Activity – WQL10 - Plant a cover crop that will scavenge residual nitrogen

Enhancement Description
Plant a cover crop that will scavenge nitrogen remaining in the soil after the harvest of a previous crop. Suitable cover crops include those with at least a "Very Good" rating for scavenging nitrogen as documented in "***Managing Cover Crops Profitably, 3rd Edition***" (Sarrantonio, 1998**),** Chart 2 Performance & Roles, pg 67**.** Examples include cereal rye, barley, forage radish and sorghum sudan.

Land Use Applicability
Cropland

Benefits
Planting an annual cover crop to scavenge residual nutrients from cropland after the harvest of a previous crop effectively utilizes residual nutrient resources to supply following crops with nutrients required to efficiently produce food, forage, fiber, and cover while minimizing environmental degradation.

Conditions Where Enhancement Applies
This enhancement applies to only annually planted crop land use acres.

Criteria
Implementation of this enhancement requires:

1. The cover crop selected shall have the growth rate and rooting depth required to effectively scavenge residual nitrogen from the root zone of the previous crop. Suitable cover crops include those with at least a "Very Good" rating for scavenging nitrogen as documented in ***Managing Cover Crops Profitably, 3rd Edition, Chart 2 Performance & Roles, pg 67.*** Examples include cereal rye, barley, forage radish and sorghum sudan.
2. Timing of planting and seeding rates for cover crops shall follow the recommendations as available in the local NRCS Field Office.
3. The participant must have a current soil test (no more than 3 years old).
4. Nitrogen application rates for the crop following the cover crop must be reduced by the "Land Grant University (LGU) recommendations to account for the recycling of N by the cover crop.

Adoption Requirements
This enhancement is considered adopted when all of the above criteria have been implemented on the land use acre.

Documentation Requirements

Documentation for each treatment area (field) and year of this enhancement describing these items:

1. A map showing where the activities are applied,
2. Cover crop species planted,
3. Cover crop planting date,
4. Cover crop seeding rate (bu/ac),
5. Annual crop planted,
6. Nitrogen application rates/amounts for the annual crop:
   a. If N application rates increased, technical justification shall be provided for the increase,
   b. If N application rates were decreased in excess of the default residual value recommended by the LGU, technical justification shall be provided for the decrease, and
7. Treatment acres.

References

Jokela, B. and M. Russelle. 2010. Perennial Forages Benefit Soils, Other Crops, & Water Quality. Forage Focus. USDA-ARS. http://www.midwestforage.org/pdf/452.pdf.pdf

Magdoff, F. and H. van Es. Cover Crops. 2000. *In* Building soils for better crops. 2nd ed. Sustainable Agriculture Network Handbook Series. National Agriculture Library. Beltsville, MD. pp 87-96.

Shipley, P.R., J.J. Meisinger and A.M. Decker. 1992. Conserving Residual Corn Fertilizer Nitrogen with Winter Cover Crops. Agron. J. 84S69-876.

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Follow Wisconsin Agronomy Technical Note 7:
ftp://ftp-fc.sc.egov.usda.gov/WI/technotes/agronomy-tn7.pdf

Document cover crop seeding rates, establishment and termination methods.

This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

Water Quality Enhancement Activity – WQL11 – Precision application technology to apply nutrients

Enhancement Description
The use of precision agriculture technologies to apply nutrients to fit variations in site-specific conditions found within fields**.**

Land Use Applicability
Cropland, Pastureland

Benefits
Precision agriculture methods are used to collect information needed to more precisely evaluate production input factors, accurately record crop yields, and precisely apply variable rates of nutrients. The primary benefit of precision agriculture techniques is the use of detailed information about within field variability to maximize nutrient use efficiency. Done properly this helps to protect surface and ground water resources.

Conditions Where Enhancement Applies
This enhancement applies to crop or pasture land use acres where:

- Crop or forage yields can be monitored and correlated to positions in the field in order to produce a geographically accurate yield map.
- Nutrients can be applied according to geographically defined management zone(s) (DMZ).

Criteria
Implementation of this enhancement requires the use of precision agriculture technologies for nutrient management. This enhancement requires the following activities:

a. Variable rate technologies (VRT) for nutrient application. This means computer-controlled equipment that adjusts fertilizer applications based on DMZ.
b. The use of yield monitoring systems. Measure yields in the field using combine-mounted sensors, volume meters or other suitable technologies. Use a GPS receiver with the equipment to correlate field location with yield to create a yield map.
c. Sample soils for nutrient analysis shall be based on DMZs.
d. As a minimum, use yield monitoring data and soils data to create DMZs maps. Apply all nutrients according to the requirements of the DMZ based on yield expectations from yield monitoring.
e. Soil tests for P and K must be no more than 3 years old. If soil or plant tissue tests are used for variable rate nitrogen application, the tests shall be current.
f. All nutrient application rates must not exceed the "Land Grant University (LGU) recommendations for the target yield expectation.

Exception: In lieu of yield monitor data for crops that are not harvested using a geospatial component measurement system; work with your NRCS State Agronomist to use a method similar to the following procedure in order to implement this enhancement:

a. Identify a realistic yield expectation (RYE) goal for the entire field-typically a 3 yr average.
b. Define the DMZs in the field and a RYE goal for the DMZ.
    i. This is accomplished by identifying a measured yield determining factor per DMZ (i.e., specific factor from a soil test result that correlates to yield).
c. Using the DMZ RYE, calculate a weighted average yield goal for the field.
d. As a check, the weighted average field RYE cannot be greater than the RYE goal for the entire field. But a single DMZ RYE can exceed the field RYE.
e. The DMZ RYE becomes the replacement for yield monitor data.

Adoption Requirements

This enhancement is considered adopted when the system as described in the criteria above have been implemented on the land use acreage. This includes the development of DMZs and the application of nutrients according to the requirements of the DMZ.

Documentation Requirements

Documentation for each field where this enhancement is applied:

1. A map showing the fields where the enhancement is applied,
2. Crops grown in each field and maps with yield monitoring results,
3. Soil sampling protocol,
4. Soil test results,
5. Map(s) showing management zones for each field,
6. Calibration of fertilizer application equipment, and
7. Nutrient application rates/amounts and application dates for each DMZ.

Note: In lieu of documenting each individual item listed in the Documentation Requirements, a Certified Crop Advisor plan that contains each of the items may be substituted.

References

International Plant Nutrition Institute (IPNI). 2012. 4R Plant Nutrition – A Manual for Improving the Management of Plant Nutrition (North American Version). IPNI, Norcross, GA.

Randall, G., J.A. Delgado and J.S Schepers. 2008. Nitrogen management to protect water resources. In Schepers and Raun (eds) Nitrogen in Agricultural Systems. SSSA Monograph. 49. Madison, WI. pp 911-945.

USDA-NRCS. 2010. Precision Nutrient Management Planning. Agronomy Technical Note. (TN) 190-AGR-3. Washington, DC.

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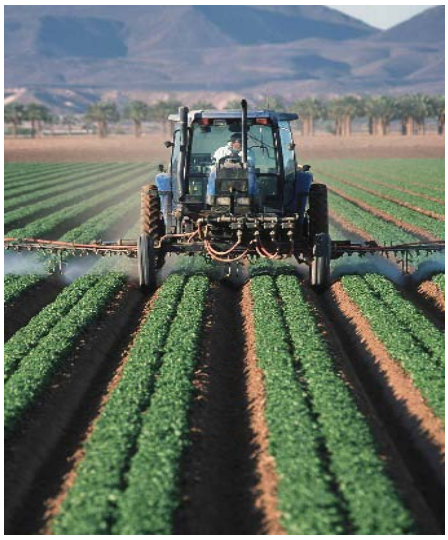
This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

Water Quality Enhancement Activity – WQL13 – High level integrated pest management to reduce pesticide environmental risk



Enhancement Description
Utilize advanced Integrated Pest Management (IPM) prevention, avoidance, monitoring, and suppression techniques, and only apply the lowest risk pesticides available (or if higher risk pesticides are used appropriate mitigation techniques are used to ameliorate the risk) in an environmentally sound manner when monitoring indicates that an economic pest threshold has been exceeded. Pesticide applications must follow all label requirements.

Land Use Applicability
Cropland, Pastureland, Rangeland, Forestland

Benefits
This enhancement will improve water and air quality by reducing toxic pesticide runoff, leaching, drift and volatilization, and also reduce pesticide impacts on pollinators and other beneficial insects.

Conditions Where Enhancement Applies
This enhancement applies to all land uses where pesticide environmental risks are present that need mitigation options to meet or exceed the criteria detailed below.

Criteria
IPM is a sustainable approach to pest control that combines the use of prevention, avoidance, monitoring and suppression strategies, to maintain pest populations below economically damaging levels, to minimize pest resistance, and to minimize harmful effects of pest control on human health and environmental resources. High level IPM suppression systems include effective agro-chemicals and cost effective biological and cultural controls as well as the lowest risk pesticides available that can sustain the cropping system.

High level IPM requires:

1. A written IPM plan and implementation of activities that include:
    a. Prevention techniques such as cleaning equipment and gear when leaving an infested area, using pest-free seeds and transplants, irrigation scheduling to avoid situations conducive to disease development, etc.
    b. Avoidance techniques such as maintaining healthy and diverse plant communities, using pest resistant varieties, crop rotation, refuge management, etc.
    c. Monitoring techniques such as pest scouting, degree-day modeling, weather forecasting, etc. to help target suppression strategies and avoid routine preventative treatments.

d. Suppression techniques such as cultural, biological and low risk chemical control methods, used judiciously to reduce or eliminate a pest population or its impacts while minimizing risks to non-target organisms.

2. A minimum mitigation index score of ≥ 45 for the identified environmental risk but not less than specified by NRCS Agronomy Technical Note #5.
3. Mitigation index scores are quantified using NRCS Agronomy Technical Note #5, Pest Management in the Conservation Planning Process.

Adoption Requirements

This enhancement is considered adopted when a management system has been implemented on the land use acreage that meets or exceed the minimum mitigation index criteria.

Documentation Requirements

1. A description of the high level IPM system that is utilized on all of the offered acres. This description should include each of the following items:
   a. Pest prevention techniques,
   b. Pest avoidance techniques,
   c. Pest monitoring (scouting) techniques,
   d. Economic pest thresholds,
   e. Pesticide environmental risk analysis tool that was utilized (e.g., the NRCS Windows Pesticide Screening Tool - WIN-PST), and
   f. Pesticide application records with the specific management techniques that were utilized to reduce pesticide environmental risk (i.e., spot treatment, banding, pheromone traps, pesticide incorporation, etc.).
2. If formal IPM Guidelines with a numeric scoring system have been developed and approved by Extension, a completed set of those guidelines can be substituted for the documentation requirements in number 1 above.

References

Ignazi,J.C. 1991. Prevention of Water Pollution by Agriculture and Related Activities. Proceedings of the FAO Expert Consultation – Water Report 1, pp 247-261.

USDA-NRCS. 2010. Conservation Practice Standard: Integrated Pest Management-Code 595

USDA-NRCS. 2011. Agronomy Technical Note No. 5 – Pest Management in the Conservation Planning Process.

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Written documentation shall include a summary of the IPM system utilized, references utilized to develop the system and a summary of the effectiveness of the most recent cropping years activities, changes planned for the coming year and any anticipated pest risks. "High level IPM" shall include local collection of temperature and moisture data, pest monitoring and scouting utilizing UW recognized protocols.

This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

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Water Quality Enhancement Activity – WQL14 – Land application of treated manure

Enhancement Description
This enhancement is for the use of manure that has been treated to reduce **both** odors and pathogens prior to land application. Acceptable practices include controlled temperature anaerobic digestion (mesophilic or thermophilic), composting and chemical treatment. Waste treatment lagoons and injection of manure alone do not qualify as acceptable practices.

Land Use Applicability
Cropland, Pastureland

Benefits
Utilizing manure for land application not only benefits crop production and soil quality, it also reduces air and water quality concerns if properly treated. Odors have been shown to be significantly reduced when manure is treated before land application. Benefits include reduced odors in the airshed. This lessens the impacts on neighboring properties along with potentially increasing the time and areas available for land application. Working conditions for employees can also be improved by the reduction in odors. An additional benefit for treating manure prior to land application is the reduction in pathogens. Human and animal health concerns are diminished due to lower pathogen counts from properly treated animal manure. Reduced or eliminated pathogens from land applied manure also decrease the likelihood water quality contamination from pathogens.

Conditions Where Enhancement Applies
This enhancement applies to crop land use acres, not including orchards and vineyards, and all pasture land use acres.

Criteria
1. Animal manure must be treated with a practice which will reduce both odors and pathogens prior to the manure being land applied. Acceptable treatment practices include:
   a. Controlled temperature anaerobic digestion (mesophilic or thermophilic)
   b. Composting
   c. Chemical treatments (as recommended by the Land Grant University)
2. Animal manure is land applied according to a nutrient management plan.

Adoption Requirements
This enhancement is considered adopted when manure has been treated via controlled temperature anaerobic digestion (mesophilic or thermophilic), composting or chemical methods

to reduce odors and pathogens, and the manure has been land applied according to a nutrient management plan.

Documentation Requirements

1. Documentation of the manure treatment practice(s) used prior to land application to obtain both odor and pathogen reduction.
2. Documentation of the land application of manure that includes:
   a. Fields where manure is applied,
   b. Manure application rate per field,
   c. Nutrients applied to each field, and
   d. Crops grown in each field.

References

International Plant Nutrition Institute (IPNI). 2012. 4R Plant Nutrition – A Manual for Improving the Management of Plant Nutrition (North American Version). IPNI, Norcross, GA.

USDA-NRCS. 2000. National Engineering Handbook, Part 637, Chapter 2, Composting, Washington, D.C.

USDA-NRCS. 1992. National Engineering Handbook, Part 651, Agricultural Waste Management Field Handbook. Washington, D.C.

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Document method of manure application, nutrient analysis of manure tests, and calibration of manure application equipment.

This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

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Water Quality Enhancement Activity – WQL17 – Use of non-chemical methods to kill cover crops

Enhancement Description
This enhancement is for the use of non-chemical methods to kill cover crops prior to planting. These methods include mowing, rolling, undercutting and weather kill.

Land Use Applicability
Cropland

Benefits
The use of non-chemical methods to kill cover crops provides a dense bio-mass that controls erosion, increases soil organic matter, reduces soil water evaporation, suppresses weeds along with other improvements in soil and water quality while eliminating potential water quality problems or other concerns from the use of herbicides.

Conditions Where Enhancement Applies
This enhancement applies to all crop land use acres, not including hayland.

Criteria

General

1. Use different methods within the cropping rotation.
2. Cash crops must be no-tilled or strip-tilled after cover crop is terminated.
3. Use of herbicides is prohibited to terminate cover crop.
4. All crops shall be killed using one of the methods described below:
   a. **Mowing**
      i. Mowing must be done using a “Flail” or “Sickle Bar” mower
      ii. Time mowing to ensure plant re-growth is minimized, e.g. after flowering in rye or midbloom or later in hairy vetch
   b. **Roller Crimping**
      i. Delay crimping until after early milk stage in cereal grain cover crops to ensure successful termination
      ii. Manage cover crops for high bio-mass production through proper selection of seed, fertilizer application and timing of planting in the fall
      iii. Cover crop must be crimped not cut
   c. **Undercutting**
      i. Use “V” blade cultivators that are run just under the surface of the soil (<2’)
      ii. Most suitable for bed production
   d. **Weather Kill**
      i. Select cover crop based on those that are most reliably killed by temperature shifts

ii. Use both summer or winter kill cover crops based on crop rotation

Adoption Requirements

This enhancement is considered adopted when one of the cover crop termination methods described above has been implemented on the land use acre.

Documentation Requirements

1. Written documentation for each year of this enhancement describing the following items:
   a. Cover crop used and date planted,
   b. Date and amount of fertilizer applied (if used),
   c. Date on which cover crop was terminated, and
   d. Cash crop planted and method used,
2. A map showing fields where the enhancement is applied.
3. Photographs of a representative number of fields showing roller crimping of cover crop.

References

Creamer, N.G. and S.M. Dabney. 2002. Killing cover crops mechanically: Review of recent literature and assessment of new research results. Amer. J. Alt. Ag. 17:32-40.

Hulugalle, N.R., L.A. Finlay and T.B. Weaver. 2011. An integrated mechanical and chemical method for managing prostrate cover crops on permanent beds. NSW Department of Primary Industries. Australian Cotton Research Institute. Australia.

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Document cover crop termination method(s).

This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

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Water Quality Enhancement Activity – WQL18 - Non-chemical pest management for livestock

Enhancement Description
The use of management, monitoring, and prevention techniques to manage external livestock pests without the use of pesticides.

Land Use Applicability
Pastureland, Rangeland, Forestland

Benefits
Environmental benefits will be operation specific. Benefits may include, but are not limited to improved animal health, reduced risk to humans and improved water quality. Pests and parasites can have a significant impact on the economic viability of livestock operations by affecting the performance and health of animals. The improper use of chemical control methods can pose risks to animal and human health as well as water quality. Nonchemical pest management strategies will require increased monitoring and management of livestock which should result in a higher overall level of management efficiency.

Conditions Where Enhancement Applies
This enhancement applies to all pasture, range or forest land use acres.

Criteria
1. Have a technical expert prepare a written plan addressing basic management considerations, including:
   a. Pests/parasites of concern, including correct species identification
   b. Monitoring process (jug traps, baited cards, on-livestock counts, fecal egg counts, FAMANCHA©, etc) to determine when control is needed and to monitor control effectiveness
   c. Sanitation, cleaning feed/hay sites, and manure removal to reduce breeding sites
   d. Rotational grazing and how it will be used to disrupt pest life cycles, minimum residual forage height to reduce parasite ingestion.
2. Incorporate two or more of the following applications into the plan as appropriate:
   a. Provide non-invasive plants with secondary compounds such as tannins and terpenes that can reduce internal parasites when grazed by livestock.
   b. Provide for multi-species grazing to disrupt life cycles of host specific parasites.
   c. Monitor dung beetle populations and enhance by eliminating or significantly reducing use of detrimental injectable, pour-on, and especially bolus type pesticides.
   d. If dung beetle populations are essentially non-existent, harrow or otherwise mechanically treat manure piles to speed up drying and decomposition.

e. Incorporate pastured poultry, such as portable poultry wagons, into pasture rotations to eat fly larvae, 2-3 days after livestock leave pasture.
f. Enhance populations of martins, swallows, and bats by providing roosts, nesting, and breeding sites as appropriate.

Adoption Requirements

This enhancement is considered adopted when a management plan has been developed, the management plan contains two or more of the sub-criteria to # 2 above, and the selected sub-criteria have been implemented.

Documentation Requirements

1. Copy of the written plan that includes:
   a. Basic management considerations,
   b. Specific selected prevention and monitoring techniques performed,
   c. Dates techniques performed,
   d. Effectiveness of applications, and
   e. Other monitoring results.
2. Schedule of when grazing occurred on pastures and residual vegetation heights both at start and end of each grazing period.

References

Dufour, Rex. 2001. Biointensive Integrated Pest Management. National Center for the Appropriate Technology (NCAT). https://attra.ncat.org/attra-pub/summaries/summary.php?pub=146.

National Center for the Appropriate Technology (NCAT). 2004. Organic Livestock Workbook – A Guide to Sustainable and Allowed Practices. http://www.co.marin.ca.us/depts/AG/Main/PDFsForOrganicAgAndMOCA/livestockworkbook.pdf.

USDA-AMS. 2012. National Organic Program Final Rule – Access to Pasture www.ams.usda.gov/NOP

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This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

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Water Quality Enhancement Activity – WQL19 – Transition to ORGANIC grazing systems

Enhancement Description
"Transition to Organic Grazing Systems" supports the conversion of a conventional to an organic livestock grazing system. Key to the enhancement activity is following ecological and pasture-based grazing requirements, applying materials according to the National List of Allowed Synthetic and Prohibited Natural Substances, and managing livestock according to National Organic Program (NOP) rules (Subpart C – Organic Production and Handling Requirements) for organic certification. This enhancement activity facilitates compliance with NOP rules for organic certification.

Land Use Applicability
Pastureland, Rangeland, Forestland

Benefits
Environmental benefits will be operation specific. Benefits may include, but are not limited to improved forage, soil, and animal health, and improved water quality.

Managing for recommended time and timing of grazing, minimum and maximum grazing heights, pasture/paddock rotation, and rest periods improve plant health, diversity, and productivity. Sufficient pasture/paddock rest or pasture/paddock avoidance that minimizes livestock contact with viable internal parasite populations can break parasite cycles, reduce ingestion of parasites and the need for treatment, and improve animal health. Soil organisms and soil quality are benefitted by the reduction or elimination of natural or synthetic pesticides typically used on forage and/or livestock. Rotating livestock through several pastures/paddocks minimizes the development of loafing areas and improves the distribution of manure nutrients for plant uptake. Nutrients are more uniformly available to forage crops and the potential for polluted runoff from high traffic areas is reduced.

Conditions Where Enhancement Applies
This enhancement applies to only pasture, range or forest land use acres in the process of transitioning to an organic production system.

Criteria
1. Manage pasture grazing and rest periods to follow NRCS Prescribed Grazing practice standard (528) criteria for recommended maximum (begin) and minimum (end) grazing

heights by forage species or Ecological Site Description interpretations. Beginning and ending grazing heights are followed to maximize forage quality and palatability and to promote rapid recovery and forage regrowth.

a. Maintain a livestock watering system that accommodates a high frequency of livestock rotation through several different pastures or paddocks during the grazing season. Follow NRCS practice standard criteria for Prescribed Grazing (528), Watering Facility (614), Pipeline (516), or other related standards for appropriate supply and travel distance to water.
b. Use fencing that is permanent, semi-permanent, and/or temporary to facilitate pasture rotation. Follow the NRCS Fence practice standard (382). Additionally, follow NOP rules for allowable fence materials.

Note: Contact your local conservationist for assistance with Conservation Practice Standards.

2. Apply all materials, including plant nutrients and pesticides for forage production and animal health, in accordance with the National List of Allowed Synthetic and Prohibited Natural Substances.
3. Comply with all NOP rules for livestock management (NOP § 205.236 - .239 for livestock origin, feed, healthcare, living conditions)
4. Complete organic transition within three (3) years as verified by obtaining an approved Organic System Plan from a valid certifying agency.
5. Follow a written grazing plan that meets the CSP eligibility requirements.

Adoption Requirements

This enhancement is considered adopted when the land use acre is certified via an Organic System Plan.

Documentation Requirements

1. Provide a written grazing plan following the 'Plans and Specifications' guidelines in the Prescribed Grazing standard. Include time and timing of grazing, minimum and maximum grazing heights, and date rotated in and date off of pastures/paddocks in the grazing plan, as appropriate for the land use.
2. Provide a record of the application of inputs according to the NOP rules, e.g., type, date, rate, and amount of allowed nutrients and pesticides for forage and livestock.
3. Provide a copy of the Organic System Plan when approved by the certifying agent.

NRCS Pasture Notes, grazer's notebook, or other record keeping systems for pasture livestock operations can be used to facilitate record-keeping.

References

Murphy, Bill. 1995. Pasture Management to Sustain Agriculture. Agroecology: The Science of Sustainable Agriculture, 2nd ed, edited by Miguel A. Altieri. Westview Press. Boulder, CO. pp. 321-347.

Bezdicek, David. 1984. Organic Farming: Current Technology and Its Role in a Sustainable Agriculture. ASA Special Publication No. 46. ASA, CSSA, and SSSA, Madison, WI. 192 P.

USDA-AMS. 2012. National Organic Program Final Rule – Access to Pasture
www.ams.usda.gov/NOP

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This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

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Water Quality Enhancement Activity –WQL20 – Transition to ORGANIC cropping systems

Enhancement Description

"Transition to Organic Cropping Systems" supports the conversion of a conventional to an organic cropping system. Key to the enhancement is the inclusion of management activities that improve water and soil quality in an "Organic System Plan (OSP)" that adheres to the National Organic Program (NOP) 205.201 criteria. Included in the plan are specifics on how producers will manage pests, weeds, diseases, and plant nutrients by following a crop rotation that incorporates cover crops and by using other cultural, biological and physical methods. The OSP also covers uses of manure and compost, measures to prevent exposure of organic crops and soils to NOP-prohibited substances, and seed sources.

Land Use Applicability

Cropland

Benefits

Environmental benefits are operation specific. Benefits may include, but are not limited to, improved soil quality through reduced erosion, increased organic matter, and balanced plant nutrients; reduced energy consumption due to the use of inputs with lower energy embodiment; wildlife habitat protection; and reduced impact on water quality. Organic transition reduces the impact of the farming operation on water quality by managing pests, weeds, and diseases through biological, mechanical, and cultural practices that eliminate the need for synthetic pesticides and by using slower-release organic and natural mineral nutrient sources that reduce nutrient losses via leaching and runoff.

Conditions Where Enhancement Applies

This enhancement only applies to crop land use acres in the process of transitioning to an organic production system.

Criteria

1. Implement a crop rotation that improves soil quality using a sod-based rotation, inclusion of high residue crops, addition of cover crops during non crop periods, reduced tillage, and/or other soil improving practices. Work with you local NRCS Field Office to calculate RUSLE2 STIR values in order to document the soil quality improvement.
2. Manage plant nutrients using agronomic practices such as:
   a. Cover crops to provide or trap nutrients,
   b. Crop rotations that mix high and low nutrient feeding crops,
   c. Deep rooted crops followed by shallow-rooted crops, and/or
   d. Soil testing to determine nutrient values for application rates of compost and other nutrient sources.

3. Incorporate manure when applied within the time limit specified in the NOP 205.203c1.
4. Follow NOP 205.203c2 before land application of composted manure and plant materials for plant nutrient use
5. Follow criteria in NOP 205.203d & e to apply additional plant nutrient supplements in such a way that they do not contribute to contamination of crops, soil, or water.
6. Manage pests through strategies that incorporate:
   a. Prevention management practices (e.g., crop rotation, sanitation measures, providing habitat for natural enemies, and selection of pest-resistant crop varieties),
   b. Scouting and monitoring of pests and beneficial insects,
   c. Suppression by using biological, mechanical, or physical practices (e.g. introduction of predators or parasites of the pest species, row covers and other barriers, cultivation or flame weeding, mulching), and
   d. Suppression by using biological, mineral or botanical materials allowed under NOP regulations, only when the above measures prove insufficient.
7. Apply all materials, including plant nutrients and pesticides for crop production in accordance with the National List of Allowed Synthetic and Prohibited Natural Substances.
8. Apply no prohibited substances, as listed in NOP §205.105 to the land for a period of 3 years immediately preceding harvest of the first crop to be marketed as USDA certified organic.
9. Establish distinct, defined boundaries and buffer zones between fields and adjacent lands to prevent the unintended application of a prohibited substance to the crop or contact with a prohibited substance applied to adjoining land that is not under organic management.

Adoption Requirements

This enhancement is considered adopted when the crop land use acre has received USDA Organic Certification.

Documentation Requirements

1. Written narrative of practices used during the transition to:
   a. Protect water resources from contamination by sediment, nutrients or pest-control materials,
   b. Improve soil quality including crop rotation, cover crops and other associated practices,
   c. Provide and manage plant nutrients, and
   d. Manage pests in the cropping system.
2. Map showing field boundaries and buffer zones.
3. RUSLE2 documents displaying STIR before and after.
4. A record of the application of inputs according to the NOP rules (e.g., type, date, rate, and amount of allowed nutrients and pesticides).
5. Documentation of practices applied and steps taken to receive organic certification based on consultation with an accredited organic certifier.
6. Copy of the Organic System Plan when approved by certifying agent and the valid USDA Organic Certificate when issued.

References

Lockeretz, W., G. Shearer, and D. Kohl. 1981. Organic farming in the Corn Belt. Science. Vol. 211, Issue 4482. pp. 540-547.

Mohler, C.L. and S.E. Johnson, editors. 2009. Crop Rotation on Organic Farms: A Planning Manual. Natural Resource, Agriculture, and Engineering Service. Cooperative Extension. IV. Series: NRAES (Series); 177.

USDA-AMS. 2011. Organic Production and Handling Standards. National Organic Program http://www.ams.usda.gov/AMsv1.0/getfile?dDocName=STELDEV3004445

USEPA. 2011. Water Quality Criteria for Nitrogen and Phosphorus Pollution. http://water.epa.gov/scitech/swguidance/waterquality/standards/criteria/aqlife/pollutants/nutrient/index.cfm

USDA-Study Team on Organic Farming. 1980. Report and Recommendations on Organic Farming. US Government Printing. Office 1980-0-310-944/96. Beltsville, MD.

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This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

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Water Quality Enhancement Activity – WQL21 – Integrated pest management for ORGANIC farming

Enhancement Description
Managing pests on an organic farm, including farms transitioning to organic, with an Integrated Pest Management (IPM) system that relies on high level prevention, avoidance, monitoring, and suppression techniques that are based on an understanding of pest ecology. Organic IPM relies primarily on ecologically-based cultural and biological practices that result in healthy soil and habitat for beneficial organisms. Appropriate mitigation techniques are utilized to improve environmental risks from selected suppression techniques.

Land Use Applicability
Cropland, Pastureland, Rangeland

Benefits
Environmental benefits will be operation specific. Benefits may include but are not limited to improved water and air quality achieved through minimizing suppression risk to natural resources. This will include reducing pesticide risks in runoff, leaching, drift and volatilization, as well as impacts on pollinators, beneficial insects and wildlife. It may also include reduced soil erosion and sediment loss from tillage for weed control. Implementing IPM increases biodiversity on the farm while improving soil quality, resulting in a more stable farming system that helps to prevent pests from overwhelming the system.

Conditions Where Enhancement Applies
This enhancement applies to all crop, pasture, or range land uses in an organic system where pesticide environmental risks are present that need mitigation options to meet or exceed the criteria detailed below.

Criteria
IPM is a sustainable approach to pest management that combines the use of prevention, avoidance, monitoring and suppression strategies, to maintain pest populations below economically damaging levels, to minimize pest resistance, and to minimize harmful effects of pest control on human health and environmental resources. If available, Land Grant University guidance should be followed for acceptable prevention, avoidance, monitoring and suppression techniques. Components of a high level Organic IPM include proactive cultural and biological controls.

High level IPM requires:

1. A written IPM plan and implementation of activities that include:
   a. Prevention techniques such as cleaning equipment and gear when leaving an infested area, using pest-free seeds and transplants, irrigation scheduling to avoid situations conducive to disease development, etc.
   b. Avoidance techniques such as maintaining healthy and diverse plant communities, using pest resistant varieties, crop rotation, refuge management, etc.
   c. Monitoring techniques such as pest scouting, degree-day modeling, weather forecasting, etc. to help target suppression strategies and avoid routine preventative treatments.
   d. Suppression techniques such as cultural, biological and low risk chemical control methods, used judiciously to reduce or eliminate a pest population or its impacts while minimizing risks to non-target organisms.
2. Only those substances listed in the National Organic Program regulations §205.601 and §205.603 may be used in the IPM program.
3. Acreage must be certified organic or in the transition to organic process.
4. A minimum mitigation index score of $\geq$ 35 for the identified environmental risk but not less than specified by NRCS Agronomy Technical Note #5.
5. Mitigation index scores are quantified using NRCS Agronomy Technical Note #5, Pest Management in the Conservation Planning Process.

Adoption Requirements

This enhancement is considered adopted when a management system has been implemented on the land use acreage that meets or exceed the minimum mitigation index criteria.

Documentation Requirements

1. A written organic IPM system plan for all of the offered acres. This plan should include each of the following items:
   a. Pest prevention techniques,
   b. Pest avoidance techniques,
   c. Pest monitoring (scouting) techniques,
   d. Economic pest thresholds,
   e. Pesticide environmental risk analysis tool that was used for pesticides selected from the NOP Prohibited and Allowed Substance list (e.g., the NRCS Windows Pesticide Screening Tool - WIN-PST),
   f. Approved pesticide application records with the specific management techniques that were utilized to reduce pesticide environmental risk (i.e., spot treatment, banding, pheromone traps, pesticide incorporation, etc.),
   g. Map showing location of fields, acreage, beneficial insect habitat, etc., and
   h. Environmental assessment of non-chemical suppression methods, e.g. cultivation, burning.
2. Copies of scouting reports and other IPM records used to monitor and evaluate the plans effectiveness
3. If formal IPM Guidelines with a numeric scoring system have been developed and approved by Extension, a completed set of those guidelines can be substituted for the documentation requirements in number 1 above.

References

Ignazi,J.C. 1991. Prevention of Water Pollution by Agriculture and Related Activities. Proceedings of the FAO Expert Consultation – Water Report 1, pp 247-261.

Mohler, C.L. and S.E. Johnson, editors. 2009. Crop Rotation on Organic Farms: A Planning Manual. Natural Resource, Agriculture, and Engineering Service. Cooperative Extension. IV. Series: NRAES (Series); 177.

USDA-AMS. 2011. Organic Production and Handling Standards. National Organic Program http://www.ams.usda.gov/AMsv1.0/getfile?dDocName=STELDEV3004445

USDA-NRCS. 2010. Conservation Practice Standard: Integrated Pest Management-Code 595

USDA-NRCS. 2011. Agronomy Technical Note No. 5 – Pest Management in the Conservation Planning Process.

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Written documentation shall include evidence of organic certification, a organic transition plan for the site or equivalent level of record keeping.

This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

Water Quality Enhancement Activity – WQL22 – On-farm composting of farm organic waste

Enhancement Description
This enhancement consists of composting organic waste generated from the agricultural operation(s) on-farm. This includes animal manures, livestock mortality (where state or local laws allow), and waste from on-farm processing of agricultural products (e.g., slaughter by-products or vegetable culls removed from the field during harvest). It does not include any hazardous household waste, any general hazardous waste products or bio-hazard waste products. Yard waste such as grass clippings and leaves can be included but are not required. Composted products must be used in compliance with all federal, state and local laws, rules and regulations.

Land Use Applicability
Cropland, Pastureland

Benefits
Composting is a resource management process that promotes an ecological farming system with focused nutrient and organic carbon cycling within an agricultural operation. Composting reduces the volume of waste, kills pathogens and reduces odors. The reuse of the compost products on the farm where they were produced improves soil quality and reduces the need to bring in additional nutrients from off-farm sources. On farms with a net import of nutrients (e.g., feed grain nutrient content exceeds nutrient content of farm products sold), the export of surplus nutrients in the form of compost turns a potential water quality concern into a beneficial product available to a wider area. The use of surplus compost by other growers has the potential to improve soil quality on their farm.

Conditions Where Enhancement Applies
This enhancement applies to farms that produce livestock manure, vegetable waste and/or other organic waste from on-farm processing facilities.

Criteria
1. **All** waste products produced on the farm that are suitable for composting may be composted. The composted products must include 75% of the animal manures produced from confinement areas, if applicable, and may also include:
   a. Livestock mortality (where state or local laws allow)
   b. Slaughter by-products

   c. Vegetable culls
   d. Waste from on farm processing of agricultural products
   e. Spoiled hay or forages

   Note: where liquid animal manure systems are used, the 75% requirement applies to the materials from a solid/liquid separation system.

The following materials shall not be included in the composting operation and plan:

   a. Poultry litter recycled to be used again as poultry litter,
   b. Composted bedded packs used for housing livestock,
   c. Hazardous household waste,
   d. General hazardous waste products,
   e. Bio-hazard waste products, and
   f. Crop residues not intended for harvest.

2. Follow a composting plan that includes:
   a. Identification of the intended use of the compost and of the required level of pathogen destruction for that use.
   b. Mixing/turning, compost time and temperature requirements to achieve pathogen destruction consistent with the intended use of the compost.
   c. Monitoring and management of composting temperatures and compost moisture levels
   d. Balancing Carbon/Nitrogen (C:N) ratio of compost feedstock, based on materials being composted
   e. Compliance with all federal, state and local laws, rules and regulations
   f. Time and temperature requirements of green waste to achieve egg destruction of any invasive pest species (ex.Coqui Frog eggs).
3. Compost site and environmental considerations
   a. Size the composting area according to the organic material being generated
   b. Divert runoff away from the composting pad
   c. Runoff from compost pad must be directed through a grass filter strip or other means to prevent water quality impartment
   d. Select a method of aerobic composting (i.e., bin, windrow or forced air composting) that is compatible with the waste product.
   e. Runoff management from the raw materials storage area, composting area and compost storage area must comply with all federal, state and local laws, rules and regulations.
4. Compost facility operation must be in accordance with NRCS Conservation Practice Standards *Composting Facility Code 317* and *Animal Mortality Facility Code 316*, as appropriate.
5. Follow Conservation Practice Standard *Nutrient Management* Code 590 for land application of composts as well as all federal, state and local laws, rules and regulations.

Adoption Requirements

This enhancement is considered adopted when the participant has established composting facilities with sufficient capacity for their composting needs and finished compost has been produced.

Documentation Requirements

1. An inventory of waste products produced on the farm,
2. An estimate of the annual quantities of compost to be produced,
3. Nutrient analysis of finished compost (by batch),
4. A location map showing the location of the composting facility(s),
5. A nutrient management plan for the land application of the compost,
6. A composting plan that identified the quantities needed, the intended use of the compost, and the composting process consistent with the intended use,
7. Farm nutrient flows and balances (including nutrients imported, nutrients exported, and nutrients recycled), and
8. Photographs of the composting facility.

References

International Plant Nutrition Institute (IPNI). 2012. 4R Plant Nutrition – A Manual for Improving the Management of Plant Nutrition (North American Version). IPNI, Norcross, GA.

NRAES-54. 1992. On-Farm Composting Handbook, Ithaca, NY.

USDA-NRCS. 1992. National Engineering Handbook, Part 651, Agricultural Waste Management Field Handbook. Washington, D.C.

USDA-NRCS. 2000. National Engineering Handbook, Part 637, Chapter 2, Composting, Washington, D.C.

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This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

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Water Quality Enhancement Activity – WQL24 – Apply enhanced efficiency fertilizer products

Enhancement Description
At least 50% of the pre-emergent and early post emergent nitrogen fertilizer and/or phosphorus fertilizers used for crop production must include enhanced efficiency formulations.

Land Use Applicability
Cropland, Pastureland

Benefits
Nutrient management encompasses managing the amount, source, placement, and timing of the application of plant nutrients and soil amendments. Nutrient management effectively utilizes available nutrient resources to supply crops with nutrients required to efficiently produce food, forage, fiber, and cover while minimizing environmental degradation.

The use of enhanced efficiency fertilizer products can make nitrogen or phosphorus available to plants over a longer portion of the growing season to match the plant uptake needs. This limits the loss of nitrogen to leaching and denitrification, and can help control soil emissions of the greenhouse gas nitrous oxide. Increased phosphorus availability improves phosphorus use efficiency and reduces the potential for loss by leaching (soluble P) and erosion (P bound to detached soil particles).

Conditions Where Enhancement Applies
This enhancement applies to all crop or pasture land use acres.

Criteria
Implementation of this enhancement requires:

1. Enhanced efficiency fertilizers, used in the State must be defined by the Association of American Plant Food Control Officials (AAPFCO) and be accepted for use by the State fertilizer control official, or similar authority, with responsibility for verification of product guarantees, ingredients (by AAPFCO definition) and label claims.
2. The use of one or more nitrogen or phosphorus fertilizer products defined as enhanced efficiency fertilizers that are recommended by the state Land Grant University (LGU) and concurred with by NRCS on all treatment acres to supply at least 50% of the LGU recommended nitrogen or phosphorus requirement for the crop(s) grown.
3. Application of nutrients within the LGU recommendations based on soil testing and established yield goals and considering all nutrient sources.
4. Minimize soil surface disturbance during fertilizer placement.

Adoption Requirements
This enhancement is considered adopted when the enhanced efficiency product, for nitrogen or phosphorus enhancement, has been utilized as a fertilizer or fertilizer additive and applied to the land use acre.

Documentation Requirements
1. A map showing where the activities are applied,
2. Enhanced efficiency product used,
3. Treatment acres,
4. Soil test results,
5. Crops grown and yields (both yield goals and measured yield),
6. Calibration of fertilizer application equipment, and
7. Nutrient application rates/amounts and application dates for each treatment area.

Note: In lieu of documenting each individual item listed in the Documentation Requirements, a Certified Crop Advisor plan that contains each of the items may be substituted.

References
AAPFCO. 2011. Association of American Plant Food Control Officials, Official Publication No. 64. AAPFCO Inc., Little Rock,Arkansas.

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Nitrogen fertilizer product must be either sulfur-coated urea or polymer-coated urea.

There are no phosphorus products recommended for Wisconsin at this time.

Document the fertilizer type, formulation, and method of application.

This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

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Water Quality and Air Quality Enhancement Activity – WQL25 – Split applications of nitrogen based on a PSNT

Enhancement Description
Use pre-sidedress soil nitrate test (PSNT) to determine the need and/or amount of additional nitrogen to be applied during a sidedress/topdress N application.

Land Use Applicability
Cropland

Benefits
Efficient use of nitrogen (N) fertilizer is important for economical crop production as well as water and air quality enhancement. Split sidedress or topdress applications of fertilizer N improve the efficiency of nutrient uptake and protect water and air resources. Pre-plant soil test nitrogen analysis (not to be confused with PSNT) can be poorly correlated with growing season soil N availability and often does not provide sufficient insight upon which to base sidedress or topdress N applications. Additionally, sidedress or topdress applications of N based on a PSNT may lower the total amount of fertilizer applied, including ammonia fertilizer, minimizing ozone damage and greenhouses gases. Nitrate, while required by plants as a nutrient, is unstable in soil and can move with water through the soil into surface and ground water. Using split applications of N based on a PSNT will minimize nitrate contamination of surface and ground water, improve N use efficiency, and reduce harmful N emissions, improving the overall greenhouse gas footprint.

Conditions Where Enhancement Applies
This enhancement applies to all annually planted crop land use acres in states where a Land Grant University approves the methodology.

Criteria
Conduct a **PSNT** on the selected crop (e.g. corn) to test if additional N fertilizer is needed (sidedress application) on fields with a history of manure application, sewage sludge, or other residual organic products or where a legume crop or a legume cover crop has been grown.

The PSNT attempts to:
1. Gauge the pool of potentially mineralizable organic N in the top foot of soil, and
2. Link that pool with a likelihood of a yield response from additional N fertilizer at sidedressing time.

Adoption Requirements
This enhancement is considered adopted when a PSNT has been conducted on the land use acre.

Documentation Requirements

Written documentation for each year of this enhancement describing the following items:

1. A map showing where the enhancement is applied,
2. Recommendations from the test,
3. Dates of split nutrient applications,
4. Type(s) of nutrients (fertilizer and organic) applied including rate, form and timing,
5. Treatment area(s),
6. Soil test results,
7. Crops grown and yields (both yield goals and measured yield), and
8. Calibration of application equipment.

Note: In lieu of documenting each individual item listed in the Documentation Requirements, a Certified Crop Advisor plan that contains each of the items may be substituted.

References

Follett, R.F. 2001. Nitrogen transformation and transport processes. *In* Nitrogen in the environment; sources, problems, and solutions, (eds.) R.F. Follett and J. Hatfield, pp. 17-44. Elsevier Science Publishers. The Netherlands. pp 520.

International Plant Nutrition Institute (IPNI). 2012. 4R Plant Nutrition – A Manual for Improving the Management of Plant Nutrition (North American Version). IPNI, Norcross, GA.

Randall, G., J.A. Delgado and J.S. Schepers. 2008. Nitrogen management to protect water resources. *In* Schepers and Raun (eds) Nitrogen in Agricultural Systems. SSSA Monograph. 49. Madison, WI. pp. 911-945.

Schepers, J.S. and W.R. Ruan(eds.). 2008. Nitrogen in agricultural systems. Agron. Monogr. no. 49, American Society of Agronomy (ASA). Crop Science Society of America (CSSA). Soil Science Society of America (SSSA). Madison, WI.

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Document timing and number/locations of samples collected, Nitrogen fertilizer type, formulation, timing, method and rate of application.

PSNT and Soil Test must be from an accredited laboratory.

Additional References:

Nutrient Applications Guidance for Field, Vegetable and Fruit Crops:
UW Publication A2809 Chapter 6 (page. 46-51)
http://learningstore.uwex.edu/assets/pdfs/A2809.pdf

The Presidedress Soil Nitrate Test: UW Extension Publication A3630
http://corn.agronomy.wisc.edu/Management/pdfs/A3630.pdf

Sampling Soils for Testing: UW Extension Publication A2100
http://www.soils.wisc.edu/extension/pubs/A2100.pdf

UW Madison Soil & Plant Analysis Lab:
http://uwlab.soils.wisc.edu/soil-nitrate/

This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

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Water Quality Enhancement Activity – WQL26 – Reduce the concentration of nutrients imported on farm

Enhancement Description
Grow at least 75% of feed for livestock on the farm and use manure from the livestock to supplement up to 50% of N, 90% of P and 90% K for crops grown on the farm.

Land Use Applicability
Cropland, Pastureland

Benefits
On livestock farms, when feed for livestock is imported on the farm and manure from the livestock is spread on the farm, over time this can result in a buildup of nutrients on the farm.

This problem is made worse if the nutrient value of the manure is not accounted and additional fertilizer is applied to crops. By growing the majority of feed for livestock on the farm and properly accounting for the nutrients in the manure when applying it to crop land, better nutrient cycling is achieved. Nutrients are not concentrated on the farm and a more sustainable operation is possible.

Conditions Where Enhancement Applies
This enhancement applies to all crop or pasture land use acres.

Criteria
1. At least 75% of feed for livestock must be grown on the farm.
2. For crops grown on the farm, manure from the livestock must be used to supplement up to:
   a. 50% of N
   b. 90% of P
   c. 90% of K

Adoption Requirements
This enhancement is considered adopted when both criteria above have been met.

Documentation Requirements
1. Total feed requirements for livestock,
2. Feed purchases from off farm,
3. Nutrient requirements for crops, and
4. Off farm nutrient purchases.

References

International Plant Nutrition Institute (IPNI). 2012. 4R Plant Nutrition – A Manual for Improving the Management of Plant Nutrition (North American Version). IPNI, Norcross, GA.

USDA-NRCS. 2000. National Engineering Handbook. Part 637, Chapter 2, Composting. Washington, D.C.

USDA-NRCS. 1992. National Engineering Handbook. Part 651, Agricultural Waste Management Field Handbook. Washington, D.C.

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Document annual nutrient balance calculations for the farm operation, address all sources of nutrients generated on the farm and an inventory of all nutrients brought to the farm operation from off farm sources.

This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

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Soil Quality Enhancement Activity – WQL27 – Drainage water management for nutrient, pathogen, or pesticide reduction

Enhancement Description
This enhancement consists of managing soil and/or surface water levels during the non-cropping season in order to reduce the loss of nutrients, pathogens, or/and pesticides from a crop field through drainage systems and into downstream receiving waters. This enhancement may also be utilized to reduce the oxidation of organic matter in the soil and/or reduce wind erosion or particulate matter (dust) emissions.

Land Use Applicability
Cropland

Benefits
This enhancement holds nutrients in the soil, reduces pathogens leaving the field, and/or reduces pesticides leaving the field when crops are not actively growing. Additional benefits may include reduction of the oxidation of organic matter and/or reduced wind erosion or particulate matter (dust) emissions.

Conditions Where Enhancement Applies
This enhancement applies to cropland that has been artificially drained (surface or subsurface) and which is flat enough that significant portions can be flooded or saturated by controlling outflow from the drainage system.

Criteria
1. Implementation of this enhancement requires compliance with the requirements of the Conservation Practice Standard, Drainage Water Management (554) and the associated plan;
2. Operate water control structures/devices to hold water surface elevations no more than 6 inches **below** the ground surface on the affected area for a minimum of 90 days per year;
3. This enhancement only applies to the areas of cropland where water levels can be effectively maintained at the desired elevations.

Adoption Requirements
This enhancement is considered adopted when a drainage water management plan that meets NRCS Conservation Practice Standard, Drainage Water Management, Code 554 has been implemented (check with your local NRCS Field Office for a copy of the practice standard) and fields are flooded such that ponding or saturated conditions meet the target hydrologic conditions in the above criteria.

Documentation Requirements

1. List of fields where this enhancement was utilized, the field size, and the equipment installed/used,
2. Dates when fields were flooded and water removed from fields, and
3. Photo documentation of saturated soil areas. Photos must be dated and labeled with field number.

References

Drury, C.F., C.S. Tan, J.D. Gaynor, T.O. Oloya and T.W. Welacky. 1996. Influence of controlled Drainage-Subirrigation on Surface and Tile Drainage Nitrate Loss. Journal Environmental Quality. Vol 25. pp 317-324. https://www.soils.org/publications/jeq/abstracts/25/2/JEQ0250020317

Fouss, J.L. and M. Sullivan. 2009. Agricultural Drainage Management Systems Task Force (ADMSTF). http://hostedweb.cfaes.ohio-state.edu/usdasdru/ADMS/411-ASCE%20EWRI%20Congress%202009%20-%20JLF%20&%20MCS.pdf

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Drainage Water Management Practice Standard:

http://efotg.sc.egov.usda.gov/references/public/WI/554.pdf

This is an 'Actual' type enhancement. Actual type enhancements must be installed in the year(s) scheduled in the contract and maintained for the duration of the contract.

Water Quantity Enhancement Activity – WQT01 – Irrigation system automation

Enhancement Description
This enhancement entails using GPS guided variable rate irrigation or other innovative technologies that allow irrigation water application based on variable site conditions within a field.

Land Use Applicability
Cropland, Pastureland

Benefits
The advantages of using variable rate irrigation or other innovative technologies to reduce water use and runoff from irrigation include conservation of water resources and energy conservation.

Conditions Where Enhancement Applies
This enhancement applies to only the irrigated acres in the crop or pasture land use.

Criteria
1. Implementation of this enhancement requires compliance with the requirements of the Conservation Practice Standard, Irrigation Water Management, Code 449 (check with your local NRCS Field Office for a copy of the practice standard).
2. Development and utilization of an irrigation prescription based on soil characteristics, topography, or crops.
   a. Use of a GPS guidance and control system which will provide for the variable application of irrigation water based on variations of soils, topography, or crops; *or*
   b. Use of an automated control system based on technologies other than GPS which will provide for variable application of irrigation water based on variations of soils, topography, or crops.

Adoption Requirements
This enhancement is considered adopted when GPS guided variable rate irrigation or other innovative technologies have been installed on the irrigated acres in the selected land use.

Documentation Requirements
1. Documentation showing the operation of a variable rate irrigation system and how it accounted for variations of soils, topography, or crops, and
2. Copy of the irrigation prescription and irrigation logs.

References

Evans, R., J. LaRue, K. Stone, B. King. 2012. Adoption of site-specific variable rate sprinkler irrigation systems. http://www.ars.usda.gov/research/publications/publications.htm?SEQ_NO_115=279907

King, B. A. and D.C. Kincaid. 2004. Variable Flow Rate Sprinkler for Site-Specific Irrigation Management. http://eprints.nwisrl.ars.usda.gov/6/1/1144.pdf

Sadler, E.J., C.R. Camp, D.E. Evans, L.J. Usrey. 1996. A Site Specific Center Pivot Irrigation System for Highly-Variable Coastal Plain Soils. http://naldc.nal.usda.gov/catalog/17999

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Written documentation shall include the manufacturer and model number of the control equipment.

This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

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Water Quantity Enhancement Activity – WQT03 – Irrigation pumping plant evaluation

Enhancement Description
This enhancement consists of the evaluation of the irrigation pumping plant performance and efficiency using the Nebraska Irrigation Pumping Plant Performance Criteria.

Land Use Applicability
Cropland, Pastureland

Benefits
A pumping plant performance test can determine the energy efficiency of an irrigation pumping plant and provide information on adjustments or modifications needed to improve the energy efficiency. Efficiency improvements come in the form of reduced energy consumption, reduced water use and better management techniques. A pumping plant test may be performed regardless of the age of the system.

Conditions Where Enhancement Applies
This enhancement applies to all irrigation pumping plants in the crop or pasture land use.

Criteria
An irrigation pumping plant performance test must be performed by a qualified service provider with appropriate testing equipment. A full and complete report must be completed by the service provider. This should include:

1. Age and condition of the components of the irrigation system and pumping plant
2. Water levels during pumping, a pressure / discharge curve
3. Pump and engine speed (rpm)
4. Actual Pump Plant Performance versus the Nebraska Performance Criteria
5. Actual pump efficiency versus the Manufacturers Published efficiency
6. Recommendations for improvements to the overall system efficiency
7. Estimate of energy savings if improvements are implemented

Note: Below is the “Nebraska Performance Standards for Irrigation Pumping Plants” table.

Adoption Requirements
This enhancement is considered adopted when a full and complete report with the seven criteria above has been developed by a trained service provider.

Documentation Requirements
A completed pumping plant evaluation report including the items identified in the above criteria.

References

Fischbach, P.E. and M.A. Schroeder. 1982. Irrigation Pumping Plant Performance Handbook. 4th Ed.

USDA-NRCS. 1997. National Engineering Handbook. Part 652. Irrigation Guide. Chapter 12. Energy Use and Conservation. Section 2.

Nebraska Performance Standards for Irrigation Pumping Plants

Energy Source	Energy Unit	Hp-hr[1] Per Unit of Energy	Water Hp-hr[2] Per Unit of Energy[3]
Diesel	Gallon	16.7	12.5
Gasoline	Gallon	11.5 [4]	8.66
Propane	Gallon	9.2 [4]	6.89
Natural Gas	1,000 cu ft	88.9[5]	66.7
Electricity	kWh	1.18[6]	0.885[7]

(1) Horsepower-hours are the work being accomplished by the power unit with losses considered.
(2) Water horsepower-hours are the work being accomplished by the pumping plant, engine or motor and pump, at the Nebraska Performance Criteria.
(3) Based on 75 percent pump efficiency.
(4) Taken from Test D of Nebraska Tractor Test Reports. Drive losses are accounted for in the data. (Assumes no cooling fan)
(5) Manufacturers' data corrected for 5 percent gear-head drive loss and no cooling fan. Assumes natural gas energy content of 1,000 Btu per cubic foot
(6) Assumes 88 percent electric motor efficiency.
(7) Direction connection, assumes no drive loss.

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Written documentation shall include the manufacturer and model number of irrigation pumping equipment currently being used.

See additional Wisconsin Supplement information on the following pages.

This is an 'Actual' type enhancement. Actual type enhancements must be installed in the year(s) scheduled in the contract and maintained for the duration of the contract.

United States Department of Agriculture
Natural Resources Conservation Service

WISCONSIN SUPPLEMENT

2013 Ranking Period 1

Water Quantity Enhancement Activity – WQT03 – Irrigation pumping plant evaluation

State Criteria (same as NATIONAL CRITERIA)
Irrigation Pumping Plant Evaluation shall be conducted in accordance with the Technical Irrigation Pumping Plant Test Procedure Manual (1982, University of Nebraska Institute of Agriculture and Natural Resources).

Documentation Requirements (SEE NATIONAL ENHANCEMENT ACTIVITY JOBSHEET)
Complete the Table below:

To be completed by NRCS and Producer during planning			To be completed by Producer during certification process	
1	**2**	**3**	**4**	**5**
Tract	**Field(s)**	**Acres Planned**	**No. of pumping plants evaluated**	**Date of irrigation pumping plant evaluation**
Ex. T100	2b	7.3		

Ex. = example. NRCS completes column 1, 2 & 3 (Tract, Field and Acres Planned). Operator completes remaining columns.

IRRIGATION PUMPING PLANT EVALUATION

Name _____ County _____ Tract No. _____

Static Water Level (ft)_____ Pumping Water Level (ft) _____
Pump Brand _____ Stages _____ Serial No. _____
Pump Setting _____ Pump Shaft Dia. _____ Threads/in_____
Pump RPM _____ Motor RPM _____

Pumping Head

Pumping Head										
Pressure at Pump Outlet (psi)		Pressure Conversion		Elevation Difference Between Pump Outlet and Pumping Water Surface (ft)		Estimated Friction Loss in Column or Suction Pipe (ft)		Miscellaneous Friction Loss (ft)		**(A)** Pumping Head (ft)
	×	2.31	+		+		+		=	

Flow Test

Flow Meter Test													
Meter Type	Minutes	Seconds		Time of Test (min)	Gallons at End of Test		Gallons at Beginning of Test		Total Gallons		Time of Test (min)		**(B)** Flow (gpm)
Propeller			=			-		=		÷		=	
Ultra Sonic or Magnetic													

Collins Flow Gauge:

10 Pt. Setting	Setting Position	Right		Left	
.158D					
.275D					
.354D					
.420D					
.475D					

Pipe I.D. _____ Average Velocity _____ x 2.45 x D^2 = _____ gpm **(B)**

General Power Unit Inventory

- ☐ Internal combustion engine, diesel, gasoline, or propane (complete page 3, Tables 1 and 2)
- ☐ Internal combustion engine, natural gas (complete page 3, Tables 3 and 4)
- ☐ Electric Motor (complete page 4, Tables 5-7)

Diesel, Gasoline, or Propane Energy Use Test

Table 1. Diesel, Gasoline, or Propane Energy Use Test

Fuel Type	Weight at Start of Test (lbs)		Weight at Stop of Test (lbs)		Net Weight Used (lbs)		Unit Weight of Fuel (lbs/gal)		Total Time of Test (hrs)		**(C)** Energy Use (gal/hr)
Diesel		-		=		÷	7.10	÷		=	
Gasoline		-		=		÷	6.00	÷		=	
Propane		-		=		÷	4.25	÷		=	

Table 2. Diesel, Gasoline, or Propane Performance Rating

Fuel Type	**(A)** Pumping Head (ft)		**(B)** Flow (gpm)		Horsepower Conversion		Water horsepower (whp)		**(C)** Energy Use (gal/hr)		Actual Plant Performance (whp hr/gal)		NPPPC (whp hr/gal)				**(D) Performance Rating (%)**
Diesel		×		÷	3960	=		÷		=		÷	12.5	×	100	=	
Gasoline		×		÷	3960	=		÷		=		÷	8.66	×	100	=	
Propane		×		÷	3960	=		÷		=		÷	6.89	×	100	=	

Natural Gas Energy Use Test

Table 3. Natural Gas Energy Use Test

		Dial Capacity		Dial Revolutions		Time of Test (sec)				Correction Factor		**(C)** Energy Use (mcf/hr)	Gas Pressure (psi)	Elevation
3.6	×		×		÷		=		×		=			

Table 4. Natural Gas Performance Rating

Fuel Type	**(A)** Pumping Head (ft)		**(B)** Flow (gpm)		Horsepower Conversion		Water horsepower (whp)		**(C)** Energy Use (mcf/hr)		Actual Plant Performance (whp hr/mcf)		NPPPC (whp hr/mcf)				**(D) Performance Rating (%)**
Natural Gas		×		÷	3960	=		÷		=		÷	66.7	×	100	=	

Electric Energy Use Test

Table 5. Electric Energy Use Test									
Meter Type			Disc Revolutions		Kh		Time of Test (sec)		**(C)** Energy Use (kW)
Dial	3.6	×		×		÷		=	
Digital									

Table 6. Electrical Characteristics				
	Leg 1	Leg 2	Leg 3	Average
Volts				
Amps				

Table 7. Electric Performance Rating																	
Energy Source	**(A)** Pumping Head (ft)		**(B)** Flow (gpm)		Horsepower Conversion		Water horsepower (whp)		**(C)** Energy Use (kW)		Actual Plant Performance (whp hr/(kWh)		NPPPC (whp hr/kWh)				**(D) Performance Rating (%)**
Electric		×		÷	3960	=		÷		=		÷	0.885	×	100	=	

Potential Savings

If the performance rating calculated for the pumping plant is less than 100 %, potential annual savings can be estimated using Tables 8 and 9. A performance rating at, or above 100% indicates that the pumping plant is operating at, or above the expected performance level as defined by the Nebraska Pumping Plant Performance Criteria (NPPPC). A performance rating below 100% indicates the pumping plant is using more energy than the criteria calls for.

Table 8. Potential Energy Savings Estimated from Annual Hours																				
		(D) Performance Rating (%)								**(C)** Energy Use (unit/hr)		**(E)** Excess Energy Consumed (unit/hr)		Annual Hours of Operation (hr/season)		Excess Energy (unit/season)		Unit Cost of Energy ($/unit)		Potential Annual Savings ($/season)
100	-		=		÷	100	=		×		=		×		=		×		=	

Table 9. Potential Energy Savings Estimated from Annual Inches Applied																			
(B) Flow (gpm)				**(F)** Water Application Capacity (ac-in/hr)	**(E)** Excess Energy Consumed (unit/hr)		Unit Cost of Energy ($/unit)		Excess Energy Cost ($/hr)		**(F)** Water Application Capacity (ac-in/hr)		Cost per Acre-Inch ($/Ac-in)		Irrigated Acres		Annual Inches Applied (in/season)		Potential Annual Savings ($/season)
	÷	452	=			×		=		÷		=		×		×		=	

Field Pump Test Data

While performing the energy use test it is required to document field pump test data. Document current pump configuration and if adjustments were made below.

Observation No.	Flow (GPM)	Well Pressure (psi)	Drawdown Pumping Level (ft)	Constant RPM ☐ Motor RPM ☐ Pump RPM
1				
2				
3				
4				

Note: Field pump test data must show data for all columns above. Flow points should be documented at a constant RPM.

Pump Adjustments*

_____ Pumping Head x _____ Downthrust = _____ Total Downthrust
_____ Shaft Stretch x _____ Shaft Length/100 = _____ Total Stretch x _____ Threads/in = _____ Turns of Nut

Age and Condition of Pumping Plant and Components_____
_____

	Current Configuration	After Adjustments*
Pumping Water Level	_____ Feet	_____ Feet
Operating Pressure	_____ psi	_____ psi
Operating Flow Rate	_____ gpm	_____ gpm
Power Requirements	_____ Whp	_____ Whp
Pump RPM	_____ RPM	_____ RPM
Engine RPM	_____ RPM	_____ RPM
Performance Rating	_____ %	_____ %

Adjustments, remarks and recommendations
_____
_____
_____
_____
_____

Date of Test: _____
Test completed by: _____
Contact Number of Tester: _____

* It is recommended that the pump adjustment be made only by trained professionals. Adjustments are not required to meet the requirements of the Conservation Security Program Enhancement Water Quality Enhancement Activity WQT03, Irrigation Pumping Plant Evaluation.
Copies of this Field Data form should be completed for each test performed and submitted to NRCS.
Form modified from Cooperative Extension Service Agricultural Engineering Department, University of Nebraska – Lincoln

Water Quantity Enhancement Activity – WQT05 – Remote monitoring and notification of irrigation pumping plant operation

Enhancement Description
A system for monitoring the status of an irrigation pumping plant and notifying the operator by a wireless connection of a change in the operating status of the irrigation system.

Land Use Applicability
Cropland, Pastureland

Benefits
Irrigation water usage and energy costs associated with pumping irrigation water are a critical resource concerns. Even the most careful managers cannot manage the water on all of their fields on a continuous basis without increasing the potential for some runoff. Real time information on the status of their irrigation systems helps to prioritize field visits to observe the system and make necessary adjustments for proper functioning. New technology monitors the status of the watering system and notifies the operator when there is a change, such as, the pump turning on or off.

Conditions Where Enhancement Applies
This enhancement applies to all the irrigation pumping plants in the crop or pasture land use.

Criteria
The pumping plant monitoring system must include:
1. Installation of necessary sensors to monitor the operation of the pumping plant and irrigation system.
2. A communication system at the pump with an automated recording and wireless communication system to automatically notify the operator of a status in the watering system.
3. The irrigation water management plan must reflect usage of the data from the system and include necessary operation and maintenance to keep the system functional.

Adoption Requirements
This enhancement is considered adopted when a monitoring system has been installed at the remote well location(s) and the subject well has a functioning automated remote notification system.

Documentation Requirements
A map delineating the locations where the monitoring systems are installed.

References

Kranz, W. 2011. Monitoring irrigation water application with computerized controllers. Proceedings of the 23rd Annual Central Plains Irrigation Conference. Burlington, CO. February 22-23, 2011.
http://www.ksre.ksu.edu/irrigate/OOW/P11/Kranz11b.pdf

Piao, X. and L. Burt. 2001. Remote monitoring and control – system set-up.
http://www.itrc.org/reports/remote/remote.pdf

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Written documentation shall include an inventory of the remote monitoring system hardware installed by location and summary of the operating protocol on how the monitoring equipment will be utilized.

This is an 'Actual' type enhancement. Actual type enhancements must be installed in the year(s) scheduled in the contract and maintained for the duration of the contract.

Water Quantity Enhancement Activity – WQT07 – Regional weather networks for irrigation scheduling

Enhancement Description
Crop evapotranspiration (crop ET) information from a regional weather network is utilized as a part of the irrigation water management plan for irrigation scheduling. Water use is planned and adjustments in application rates and timing are made using the regional weather network data.

Land Use Applicability
Cropland, Pastureland

Benefits
The use of data from regional weather networks can improve a farmer's estimate of evapotranspiration from irrigated crops. This information combined with local rainfall data and monitoring of soil moisture can significantly improve the accuracy of irrigation timing and application rates. Benefits include reduced aquifer depletion, and reduced runoff and deep percolation, both of which reduce movement of agrichemicals from farm fields to aquifers, lakes, and streams.

Conditions Where Enhancement Applies
This enhancement applies to irrigated cropland or pastureland where regional weather data is not currently used to schedule irrigation events.

Criteria
This enhancement requires:
1. A subscription to a regional weather network that supplies crop ET values for irrigation scheduling.
2. The crop ET information from the network must be used as part of the irrigation water management plan to match water application rates and timing to the needs of the crops and soils.

Adoption Requirements
This enhancement is considered adopted when the applicant has a valid subscription to a regional weather service, has developed an irrigation water management plan based on the ET data from the regional weather network and has a record of irrigation events based on the ET data from the regional weather network.

Documentation Requirements
1. Documentation of subscription to a regional weather network.

2. An irrigation water management plan showing the use of the crop ET data from a weather network in irrigation scheduling.
3. A record of actual irrigation events based on the ET data from the weather network.

References

Elliott, R.L., K.G. Hubbard, M.D. Brusberg, M.J. Hattendorff, T.A. Howell, T.H. Marek, R.L. Snyder. 2000. The Role of Automated Weather Networks in Providing Evapotranspiration Estimates. Proceedings of the 4th Decennial National Irrigation Symposium. November 2000. pp 243-250. http://www.cprl.ars.usda.gov/wmru/pdfs/The%20role%20of%20automated%20weather%20networks%20in%20providing%20evapotr.pdf

Pierce, F.J. and T.V. Elliott. 2008. Regional and on-farm wireless sensor networks for agricultural systems in Eastern Washington. http://www.sciencedirect.com/science/article/pii/S0168169907001664

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Regional weather data and crop ET estimates are available (without subscription) from:

http://www.soils.wisc.edu/uwex_agwx/awon/
http://www.soils.wisc.edu/uwex_agwx/sun_water/et_wimn

An irrigation scheduling spreadsheet is located at:

http://www.soils.wisc.edu/uwex_agwx/sun_water/spreadsheet_download
http://www.soils.wisc.edu/uwex_agwx/sun_water/spreadsheet_doc

This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.

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Water Quantity Enhancement Activity – WQT08 – Decrease irrigation water quantity or conversion to non-irrigated crop production

Enhancement Description
This enhancement consists of reducing the total quantity of irrigation water used to produce crops and forages or the conversion of land to non-irrigated production.

Land Use Applicability
Cropland, Pastureland

Benefits
In areas where ground water or surface water supplies are limited, the reduction of irrigation water used or the conversion of irrigated cropland or pasture to non-irrigated (dry) cropland, non-irrigated pasture or range land, has the immediate benefit of conserving a scarce resource. Where irrigation water is pumped, elimination of pumping will also reduce energy usage and improve air quality if internal combustion engines were used for pumping on the farm.

Conditions Where Enhancement Applies
This enhancement only applies to crop or pasture land uses where there is acreage that has been irrigated a minimum of 2 years out of the last 5 years.

Criteria
1. The water that would have been used for irrigating land where this enhancement is implemented cannot be used to irrigate other acreage on the farm or the water rights sold to another landowner.
2. The land must:
   a. Receive a reduced quantity of irrigation water due to rotational adjustments, and/or
   b. Be converted to growing crops, pasture species or other vegetation that can be expected to survive under the normally expected rainfall regime.
3. Regardless of the type of vegetation grown on the land after removal of irrigation or reduction of water application, invasive species must be managed.
4. Conversion to dryland production or the reduction of irrigation application must include the necessary changes in management of the land to improve the success of the change, such as, changes to drought tolerant crops or cultivars, changed crop rotations and installation of moisture capturing practices (i.e., mulch tillage, no-till, reduced tillage, chemical weed control versus conventional tillage, herbaceous wind barriers, trap strips, strip cropping, etc.),and practices to maintain erosion at or below soil loss tolerance (T).
5. A flow meter must be installed to measure quantities of water used. Open channel systems may utilize irrigation district measurements to determine quantities of water used.
   Note: Ditch riders meet the intent of this criterion.
6. The total cumulative quantity of irrigation water must be reduced by 25% and maintained at

25% or more over the rotation (i.e., from the initiation of the reduction to the end of the agreement with NRCS).

Adoption Requirements

This enhancement has been adopted when the cumulative irrigation water quantity has been decreased by 25% as compared to the previous 5 years.

Documentation Requirements

1. A map showing areas of quantity reduction or conversion to non-irrigated land,
2. Documentation of the amount of water used for irrigation in the previous 2 to 5 years (use the maximum number of years possible),
3. Flow meter measurements for each crop for the entire rotation,
4. Record of crop rotation and species (cultivars) planted,
5. Records that show cumulative reduction in irrigation water application for rotation,
6. Documentation recording implementation of required management practices, and
7. Documentation that water saved was not used on other part of the operation or sold to another landowner.

References

Amosson, S.H., L.K. Almas, F. Bretz, D. Gaskins, B. Guerrero, D. Jones, T. Marek, L. New and N. Simpson. 2006. Water Management Strategies for Reducing Irrigation Demands in Region. Prepared for Agricultural Sub-Committee, Panhandle Water Planning Group.
http://www.twdb.state.tx.us/rwpg/2006_RWP/RegionA/Appendices/Appendix%20Q.pdf

Cropping Options for Limited Water Supplies in Northeast Colorado, 2003

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This is a 'System' type enhancement. This enhancement shall be performed on the areas (i.e. fields) identified in the Conservation Stewardship Plan each year when appropriate to do so.