

NATURAL RESOURCES CONSERVATION SERVICE
 CONSERVATION PRACTICE STANDARD
NUTRIENT MANAGEMENT
 (Acre)
CODE 590

DEFINITION

Managing the amount, source, placement, form and timing of the application of nutrients and soil amendments.

PURPOSES

- ◆ To budget and supply nutrients for plant production.
- ◆ To properly utilize manure or organic by-products as a plant nutrient source.
- ◆ To minimize agricultural nonpoint source pollution of surface and ground water resources.
- ◆ To maintain or improve the physical, chemical and biological condition of soil.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all lands where plant nutrients and soil amendments are applied.

CRITERIA

General Criteria Applicable to All Purposes

Plans for nutrient management shall comply with all applicable Federal, state, and county laws, such as Clean Water Act and CEQA.

Plans for nutrient management shall be developed in accordance with policy requirements of the NRCS General Manual Title 450, Part 401.03 (Technical Guides, Policy and Responsibilities) and Title 190, Part 402 (Ecological Sciences, Nutrient

Management, Policy); technical requirements of the NRCS Field Office Technical Guide (FOTG); procedures contained in the National Planning Procedures Handbook (NPPH), and the NRCS National Agronomy Manual (NAM) Section 503.

Persons who review or approve plans for nutrient management shall be certified using the procedure found in 180 GM part 409.

Plans for nutrient management that are elements of a more comprehensive conservation plan shall recognize other requirements of the conservation plan and be compatible with its other requirements.

A nutrient budget for nitrogen shall be developed that considers all potential sources of nutrients including, but not limited to animal manure and organic by-products, waste water, commercial fertilizer, crop residues, legume credits, and irrigation water. A nutrient budget for phosphorus is required for fields rated "Medium" or higher risk using the P Index. Budgets for P and K may be prepared to illustrate excessive or inadequate agronomic application rates, as needed.

Realistic yield goals shall be established based on soil productivity information, historical yield data, climatic conditions, level of management and/or local research on similar soil, cropping systems, and soil, tissue, and manure/organic by-products tests. For new crops or varieties, industry

yield recommendations may be used until documented yield information is available.

Plans for nutrient management shall specify the form, source, amount, timing and method of application of nutrients on each field to achieve realistic production goals, while minimizing nitrogen and/or phosphorus movement to surface and/or ground waters.

Erosion, runoff, and water management controls shall be installed, as needed, on fields that receive nutrients.

Soil Sampling and Laboratory Analysis (Testing)

Nutrient planning shall be based on current soil, tissue, water, manure, and organic byproducts test results developed in accordance with University of California guidance or industry practice if recognized by the University of California. Current soil tests for P and K are those that are no older than three years. Soil tests for N will be taken as required by the plan. Soil samples shall be collected and prepared according to the University of California guidance or standard industry practice. Test analyses shall be performed by laboratories that are accepted in one or more of the following programs:

- ◆ Environmental Laboratory Accreditation Program (ELAP), <http://www.dhs.ca.gov/ps/ls/elap/elapindex.htm>
- ◆ The North American Proficiency Testing Program (Soil Science Society of America), <http://tal.agsci.usu.edu/~tal/soil.science/usual/aglab.pt/California.html>, or
- ◆ Laboratories whose tests are accepted by the University of California.

Soil testing shall include analysis for any nutrients for which specific information is needed to develop the nutrient plan.

Request analyses pertinent to monitoring or amending the annual nutrient budget, e.g. pH, electrical conductivity (EC), soil organic matter, nitrogen, phosphorus, and potassium.

Plant Tissue Testing

Tissue sampling and testing, where used, shall be done in accordance with University of California standards or recommendations or other methods approved by the University of California. Refer to UC Bulletin 1879

Nutrient Application Rates

Soil amendments shall be applied, as needed, to adjust soil pH to the specific range of the crop for optimum availability and utilization of nutrients. Consider practice 738 Soil Salinity Control and consult UC publications on soil amendments.

Recommended nutrient application rates shall be based on University of California guidelines (and/or industry practice when recognized by the university) and consider current soil or tissue test results, realistic yield goals, all nutrient sources, and management capabilities. Recommended applications shall be based on realistic yield goals and associated plant nutrient removal rates found in local UC research reports or those recognized by UC, UC published crop specific IPM Manuals and Production Manuals, or the Western Fertilizer Handbook where the above references are not available.

The planned rates of nutrient application, as documented in the nutrient budget, shall be determined based on the following guidance:

- ◆ **Nitrogen Application** - Planned nitrogen application rates shall match the recommended rates as closely as possible, except when manure or other

organic by-products are a source of nutrients. When manure or other organic by-products are a source of nutrients, see “Additional Criteria” below. Nitrogen application shall be undertaken using specific guidance contained in the plan, and considering all sections of this standard.

Phosphorus Application - Planned phosphorus application rates shall match the recommended rates as closely as possible and be applied according to the California P Index.

Use of the California Phosphorus Index

The P Index, located in Section I of the FOTG, will be used for evaluating P application with organic or commercial fertilizers. Refer to UC Bulletin 1879 for guidance on crop response thresholds and soil and tissue sampling methods. Initially use the “California P Index – Initial Risk Assessment” to determine the level of risk assessment needed based on P impacts on local surface waters. For all fields the following applies:

- 1) If the field is found to be in the Low or Medium Risk categories, commercial P fertilizers may be applied at agronomic rates according to University guidelines using P response thresholds for the crop, and utilizing soil and/or tissue analysis. Manure fertilizers may be applied based on the N requirement of the crop and the N content of the manure. Fields in the Medium Risk category should be periodically reviewed using the P Index since they may move into the High Risk category when no management changes are made. Medium and higher risk fields will require a P budget.
- 2) If the field is found to be in the High Risk category then manure may be

applied at a P Based rate for crop removal. Estimate P removal from UC recognized locally available research, UC published IPM or Production Manuals, or the Western Fertilizer Handbook when the other sources are not available. Manure P content will be determined using laboratory analysis. Commercial fertilizer may be applied according to UC guidelines and P response thresholds for the crop, utilizing soil and/or tissue analysis. A conservation plan must be in place that will lower the risk category to at least Medium when implemented. Medium and higher risk fields will require a P budget. After implementation the actions required at the lower risk levels will apply.

- 3) If the field is in the Very High Risk category of the P index no manure or other organic sources of P may be applied. Commercial fertilizer may be applied according to UC guidelines and P response thresholds for the crop, utilizing soil and/or tissue analysis. However, when soil test P levels meet or exceed 80 ppm (Olsen) or 120 ppm (Bray) no P from any source may be applied, except as provided for below. When planting winter vegetables in soils below 55 degrees Fahrenheit a starter fertilizer of 30 lbs/ac or less P₂O₅ may be injected at seeding. A conservation plan must be in place and being applied that will lower the risk level for the field to at least High Risk when implemented. Medium and higher risk fields will require a P budget. After implementation the actions required at the lower risk levels will apply.

When manure or other organic by-products are a source of nutrients, see “Additional Criteria” below.

Potassium Application - Excess potassium shall not be applied in situations in which it causes unacceptable nutrient imbalances in crops or forages that can not be managed by changes in animal feed rations. Supplements containing P that are used to manage excess dietary K should not be used when P is known to affect local surface water.

- ◆ **Other Plant Nutrients** - The planned rates of application of other nutrients shall be consistent with diagnostic testing, knowledge of local micronutrient needs available at the UCCE office, published University of California guidance such as IPM or Crop Production Manuals, or industry practice if recognized by the University of California.
- ◆ **Starter Fertilizers** - Starter fertilizers containing nitrogen, phosphorus and potassium may be applied in accordance with University of California recommendations, as published in IPM or Production Manuals, other UC publications, or industry practice if recognized by the University of California. When starter fertilizers are used, they shall be included in the nutrient budget.

Nutrient Application Timing

Timing of nutrient application shall correspond as closely as possible to plant nutrient uptake characteristics, while considering cropping system limitations, manure mineralization, weather and climatic conditions, and field accessibility.

Nutrient Application Methods

Nutrients shall not be applied to frozen, snow-covered, or saturated soil if the

potential risk for runoff or leaching exists. When practical, application methods will be chosen to minimize the risk of nutrient loss off site from runoff, leaching, or volatilization.

Nutrient applications associated with irrigation systems shall be applied in accordance with the requirements of Irrigation Water Management (Code 449).

Additional Criteria Applicable to Manure or Organic By-Products Applied as a Plant Nutrient Source

Nutrient values of manure and organic by-products (excluding sewage sludge) shall be determined prior to land application based on laboratory analysis when practical. For other circumstances, “book values” recognized by the NRCS or published in University of California bulletins or manuals, or historic records for the operation, if they accurately estimate the nutrient content of the material, may be substituted. Book values recognized by NRCS may be used when University of California does not have established values. NRCS recognized values are found in the Agricultural Waste Management Field Handbook, Chapter 4 - Agricultural Waste Characteristics, and the Western Fertilizer Handbook.

Nutrient Application Rates

Where not restricted by local ordinance, the application rate (in/hr) for manure or fertilizer applied through sprinkler irrigation shall not exceed the soil intake/infiltration rate as indicated by the occurrence of runoff. Runoff from irrigation when applying fertilizer, manure, or by-products shall be contained on-farm. The total application shall not exceed that necessary to reach the field capacity of the soil. Assess the available storage space in the soil profile prior to application.

The planned rates of nitrogen and phosphorus application recorded in the plan shall be determined based on the following guidance:

- ◆ **Nitrogen Application** - When the plan is being implemented on a phosphorus standard, manure or other organic by-products shall be applied at rates consistent with the phosphorus requirement of the crop. In such situations, an additional nitrogen application, from non-organic sources, may be required to supply the recommended amounts of nitrogen.

Manure or other organic by-products may be applied on legumes at rates equal to the estimated removal of nitrogen in harvested plant biomass.

- ◆ **Phosphorus Application** - When manure or other organic by-products are used, the planned rates of phosphorus application shall be consistent with the Phosphorous Index.

Use of the California Phosphorus Index

The P Index, located in Section I of the FOTG, will be used for evaluating P application with organic or commercial fertilizers. Refer to UC Bulletin 1879 for guidance on crop response thresholds and soil and tissue sampling methods. Initially use the “California P Index – Initial Risk Assessment” to determine the level of risk assessment needed based on P impacts on local surface waters. For all fields the following applies:

1. If the field is found to be in the Low or Medium Risk categories, commercial P fertilizers may be applied at agronomic rates according to University guidelines using P response thresholds for the crop, and utilizing soil and/or tissue analysis. Manure fertilizers may

be applied based on the N requirement of the crop and the N content of the manure. Fields in the Medium Risk category should be periodically reviewed using the P Index since they may move into the High Risk category when no management changes are made. Medium and higher risk fields will require a P budget.

2. If the field is found to be in the High Risk category then manure may be applied at a P Based rate for crop removal. Estimate P removal from locally available UC recognized research, UC published IPM or Production Manuals, or the Western Fertilizer Handbook when the other sources are not available. Manure P content will be determined using laboratory analysis. Commercial fertilizer may be applied according to UC guidelines and P response thresholds for the crop, utilizing soil and/or tissue analysis. A conservation plan must be in place that will lower the risk category to at least Medium when implemented. Medium and higher risk fields will require a P budget. After implementation the actions required at the lower risk levels will apply.
3. If the field is in the Very High Risk category of the P index no manure or other organic sources of P may be applied. Commercial fertilizer may be applied according to UC guidelines and P response thresholds for the crop, utilizing soil and/or tissue analysis. However, when soil test P levels meet or exceed 80 ppm (Olsen) or 120 ppm (Bray) no P from any source may be applied, except as provided for below. When planting winter vegetables in soils below 55 degrees Fahrenheit a starter fertilizer of 30 lbs/ac or less

P₂O₅ may be injected at seeding. A conservation plan must be in place and being applied that will lower the risk level for the field to at least High Risk when implemented. Medium and higher risk fields will require a P budget. After implementation the actions required at the lower risk levels will apply.

A single application of phosphorus applied as manure may be made at a rate equal to the recommended phosphorus application or estimated phosphorus removal in harvested plant biomass for the crop rotation or multiple years in the crop sequence.

When such applications are made, the application rate shall:

- not exceed the recommended nitrogen application rate during the year of application, or
- not exceed the estimated nitrogen removal in harvested plant biomass during the year of application when there is no recommended nitrogen application.
- be consistent with the P Index risk category of the field.

Field Risk Assessment

When a field is located in an area contributing P to a water body on the 303d list because of impacts of P from an agricultural source, and animal manure or other organic by-products are applied, a field-specific assessment of the potential for phosphorus transport from the field shall be completed. This assessment is appropriate in other situations when desired by the producer. This assessment may be done using the Phosphorus Index or other recognized assessment tool when developed. In such cases, plans shall include:

- ◆ a record of the assessment rating for each field or sub-field, and
- ◆ information about conservation practices and management activities that can reduce the potential for phosphorus movement from the site.

When such assessments are done, the results of the assessment and recommendations shall be discussed with the producer during the development of the plan.

Heavy Metals Monitoring

When sewage sludge is applied, the accumulation of potential pollutants (including arsenic, cadmium, copper, lead, mercury, selenium, and zinc) in the soil shall be monitored in accordance with the US Code, Reference 40 CFR, Parts 403 and 503, and/or any applicable state and local laws or regulations.

Additional Criteria to Minimize Agricultural Non-point Source Pollution of Surface and Ground Water Resources

In areas with identified or designated water quality impairment from agricultural P, such as 303d listing, an assessment shall be completed of the potential for phosphorus transport from the field. The Phosphorus Index (PI), or other recognized assessment tool when developed, may be used to make these assessments. The results of these assessments and recommendations shall be discussed with the producer and included in the plan.

Where groundwater used for drinking, or other beneficial use impaired by nitrate, is at risk from nitrate leaching, management alternatives to minimize leaching will be developed and discussed with the producer. Areas of the farm with high leaching potential will be designated on the plan map. As necessary, management

alternatives specific to these areas will be developed with the producer and included in the plan. Alternatives will consider both nitrogen management and irrigation water management.

When fertilizers or manure with high salt content are applied in a groundwater basin impacted by, or being protected from salinity, leaching will be limited to that needed to maintain the salinity level in the rootzone at the required level for crop productivity. Refer to UC Publication “Agricultural Salinity and Drainage, A Handbook for Water Managers”, 1993, or FAO Irrigation and Drainage Paper #29 “Water Quality for Agriculture”, or equivalent.

Plans developed to minimize agricultural nonpoint source pollution of surface or ground water resources shall include practices and/or management activities that can reduce the risk of nitrogen or phosphorus movement from the field.

Additional Criteria to Improve the Physical, Chemical, and Biological Condition of the Soil.

Nutrients shall be applied in such a manner as not to degrade the soil’s structure, chemical properties, or biological condition. Use of nutrient sources with high salt content will be minimized unless provisions are used to leach salts below the crop root zone. Refer to UC Publication “Agricultural Salinity and Drainage, A Handbook for Water Managers”, 1993, FAO Irrigation and Drainage Paper #29 “Water Quality for Agriculture”, or equivalent.

Nutrients shall not be applied to flooded or saturated soils when the potential for soil compaction and creation of ruts is high.

CONSIDERATIONS

Consider induced deficiencies of nutrients due to excessive levels of other nutrients.

Consider additional practices such as Conservation Cover (327), Grassed Waterway (412), Contour Buffer Strips (332), Filter Strips (393), Irrigation Water Management (449), Riparian Forest Buffer (391A), Conservation Crop Rotation (328), Soil Salinity Control (738), Air Management (705), Irrigation Erosion Control (716), Cover Crop(340), and Residue Management (329A, 329B, or 329C, and 344) to improve soil nutrient and water storage, infiltration, aeration, tilth, diversity of soil organisms and to protect or improve water quality.

Consider cover crops whenever possible to utilize and recycle residual nitrogen.

Consider application methods and timing that reduce the risk of nutrients being transported to ground and surface waters, or into the atmosphere. Suggestions include:

- ◆ split applications of nitrogen to provide nutrients at the times of maximum crop utilization
- ◆ avoid or carefully plan fall or winter nutrient application for spring seeded crops to limit N loss from leaching, denitrification, and volatilization or P loss from erosion or runoff.
- ◆ band applications of phosphorus near the seed row
- ◆ apply materials uniformly to fields or as prescribed by precision agricultural techniques

- ◆ incorporate manure or organic by-products immediately after application
- ◆ delay field application of manure or other organic by-products if precipitation capable of producing runoff and erosion is forecast within 24 hours of the planned application.
- ◆ Consider foliar application of nutrients

Consider minimum application setback distances from environmentally sensitive areas, such as streams, wells, gullies, ditches, surface inlets or rapidly permeable soil areas. Refer to local ordinances or guidelines and the California Environmental Handbook.

Consider the potential problems from odors associated with the land application of manure, especially when applied near or upwind of residences.

Consider nitrogen volatilization losses associated with storage, handling, and land application of manure. Nitrogen losses can be significant. Ammonia volatilization can contribute to PM_{2.5} during the winter in areas subject to atmospheric inversion layers and dense ground fog.

Consider denitrification losses of N from poorly drained soils.

Consider the potential to affect National Register listed or eligible cultural resources.

Consider using current year soil test information when developing or revising plans, particularly if manure is to be a nutrient source.

Consider annual reviews to determine if changes in the nutrient budget are desirable (or needed) for the next planned crop.

Consider other sampling techniques where useful or when special environmental circumstances exist. (For example: soil

profile sampling for nitrogen, pre-sidedress nitrogen test, pre-plant soil nitrate test, or soil surface sampling for phosphorus accumulation or pH changes.)

Consider ways to modify the chemistry of animal manure, including modification of the animal's diet to reduce the manure nutrient content, to enhance the producer's ability to manage manure effectively.

PLANS AND SPECIFICATIONS

Plans and specifications shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose(s), using nutrients to achieve production goals and to prevent or minimize water quality impairment.

The following components shall be included in the nutrient management plan:

- ◆ aerial photograph or map showing farm infrastructure and a soil map of the site,
- ◆ current and/or planned plant production sequence or crop rotation,
- ◆ results of soil, plant, water, manure or organic by-product sample analyses,
- ◆ realistic yield goals for the crops in the rotation,
- ◆ quantification of all nutrient sources,
- ◆ recommended nutrient rates, timing, form, and method of application and incorporation,
- ◆ location of designated sensitive areas or resources and the associated, nutrient management restriction,
- ◆ guidance for implementation, operation, maintenance, recordkeeping, and
- ◆ complete nutrient budget for nitrogen for the rotation or crop sequence.

- ◆ complete nutrient budget for phosphorus and potassium for the rotation or crop sequence, where required, as defined by this standard.

If increases in soil phosphorus levels are expected in a designated environmentally sensitive area, plans shall document:

- ◆ P Index rating for each field, and for fields rated Medium Risk or higher, alternative practices to address the expected increases.
- ◆ the relationship between soil phosphorus levels and potential for phosphorus transport from the field, and
- ◆ the potential for soil phosphorus drawdown from the production and harvesting of crops.

When applicable, plans shall include other practices or management activities as determined by specific regulation, program requirements, or producer goals.

In addition to the requirements described above, plans for nutrient management shall also include:

- ◆ discussion about the relationship between nitrogen and phosphorus transport and water quality impairment. The discussion about nitrogen should include information about nitrogen leaching into ground water and potential health impacts. The discussion about phosphorus should include information about phosphorus accumulation in the soil, the increased potential for phosphorus transport from the field, and the types of water quality impairment that could result from phosphorus movement into surface water bodies.

- ◆ discussion about how the plan is intended to prevent the nutrients (nitrogen and/or phosphorus) supplied for production purposes from contributing to water quality impairment.
- ◆ a statement that the plan was developed based on the requirements of the current standard and any applicable Federal, state, or local regulations or policies; and that changes in any of these requirements may necessitate a revision of the plan.

OPERATION AND MAINTENANCE

The owner/client is responsible for safe operation and maintenance of this practice including all equipment. Operation and maintenance addresses the following:

- ◆ periodic plan review to determine if adjustments or modifications to the plan are needed. As a minimum, plans will be reviewed and revised with each soil test cycle.
- ◆ Nutrient management plans are based on projected conditions and must be applied with flexibility. The producer must respond to changing circumstances using the principles included in this practice standard and the plan.
- ◆ protection of fertilizer and organic by-product storage facilities from weather and accidental leakage or spillage.
- ◆ calibration of application equipment to ensure uniform distribution of material at planned rates. Manure water volume should be estimated with 90% accuracy.

- ◆ documentation of the actual rate at which nutrients were applied. When the actual rates used differ from or exceed the recommended and planned rates, records will indicate the reasons for the differences.
- ◆ Maintaining records to document plan implementation. As applicable, records include:
 - soil test results and recommendations for nutrient application,
 - quantities, analyses and sources of nutrients applied,
 - dates and method of nutrient applications,
 - crops planted, planting and harvest dates, yields, and crop residues removed,
 - results of water, plant, and organic by-product analyses, and
 - dates of review and person performing the review, and recommendations that resulted from the review.

Records should be maintained for five years; or for a period longer than five years if required by other Federal, state, or local ordinances, or program or contract requirements. Records must be maintained by the producer and need not be maintained in NRCS files unless required to document required actions for payment under a contract. Other requirements may be associated with specific contract or program needs.

Workers shall be protected from and avoid unnecessary contact with chemical fertilizers and organic by-products. Protection should include the use of protective clothing when working with plant nutrients. Extra caution must be

taken when handling ammonia sources of nutrients, or when dealing with organic wastes stored in unventilated enclosures. Contact the local Agricultural Commissioner for guidance.

The disposal of material generated when cleaning nutrient application equipment shall be accomplished properly and in accordance with local, state, or federal law. Excess material should be collected and stored or field applied in an appropriate manner. Excess material should not be applied on areas of high potential risk for runoff and leaching.

The disposal or recycling of nutrient containers should be done according to state and local guidelines or regulations.