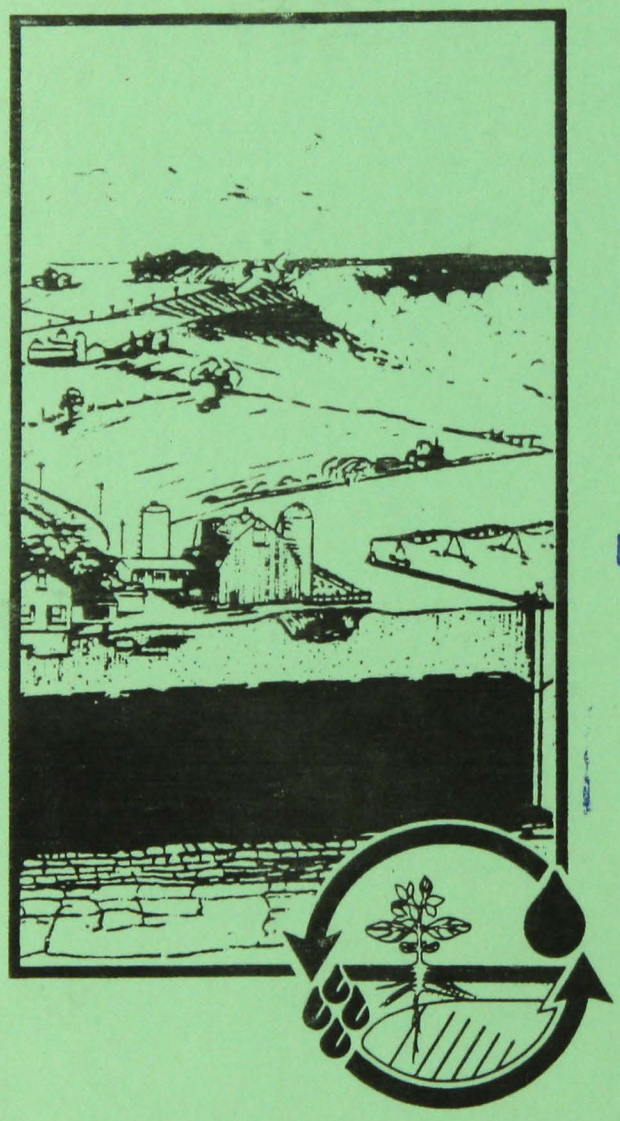
Development Of Prototype Standards And Specifications



State Nutrient And Pest Management Standards And Specifications Workshop

July 19 – 20, 1989

SOIL CONSERVATION SERVICE PROCEDURE MANUAL:

Development of Standards and Specifications for Nutrient and Pest Management

Section 3: Development of Prototype Standards and Specifications

Section 3

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SECTION 3: Development of Prototype Standards and Specifications.

3.1 Purpose and Objectives

To provide information on nutrient and pest management practices to individual landowners and producers has not routinely been a part of SCS technical assistance efforts. However, with increasing concerns about agricultural management practices and their impacts on surface and groundwater quality, it is apparent that these practices need to be addressed.

In most states the Cooperative Extension Service has responsibility for preparing nutrient and pest management recommendations based on research and to deliver this information as educational programming.

The objectives of this section are to show by example how 1) Extension recommendations can be incorporated in field office technical guides, 2) that development of this information can increase the ability of SCS field personnel to deal with questions on nutrient and pest management, 3) coordinate the delivery of this information to landowners by Extension Service and SCS, 4) share these materials with appropriate state agriculture and water quality agencies, 5) addressing training needs for ES and SCS staff, and 6) outline research needs indicated during this project.

3.2 Establishment of Standards and Specifications by States

The approach to establishment of individual states standards and specifications varied only slightly. In all cases, development started with contacts between SCS state staff and ES to begin the process of discussing development of the standards in light of ES recommendations.

Following the initial discussions, both management level and technical people were contacted in the appropriate state agencies. This was done to allow opportunity for comment and review of the standards and specifications. In addition, in all states there is a designated state agency which has responsibility for regulating the use, application, storage and handling of nutrients and pesticides.

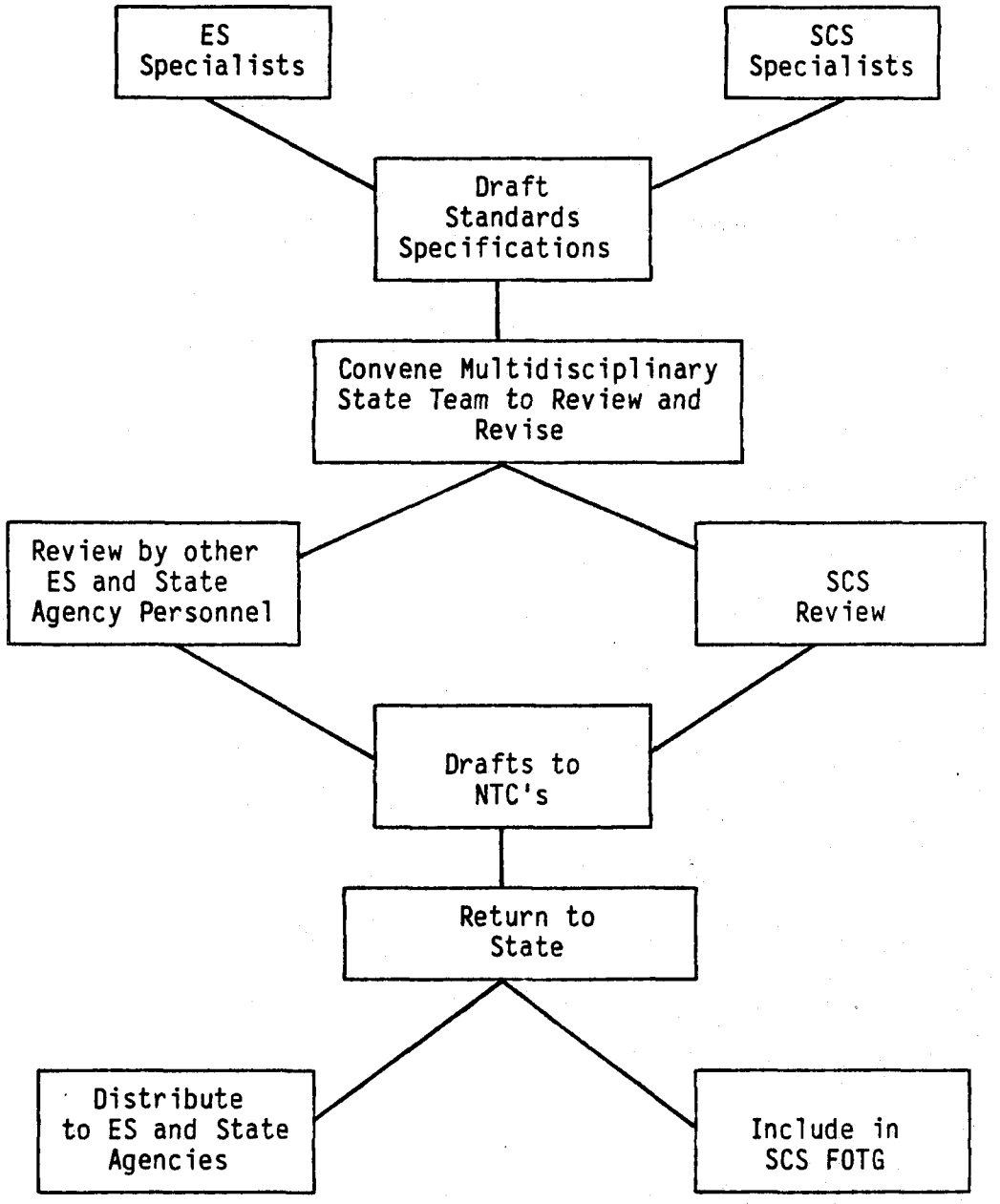
To adequately address landowner, concerns about issues of handling, storage and safety require the input of these appropriate state agencies.

In each state the interdisciplinary team made up of appropriate specialists from SCS, ES and state agencies developed drafts of the standards and specifications. These drafts were then distributed for review within the state to other SCS, ES,

state agency and industry personnel for review and comment.

Drafts were then submitted to the appropriate National Technical Center staff in the respective regions.

Figure 1. Outline of Process to Development Nutrient and Pest Management Standards and Specifications.



Following review and approval at the NTC's, the drafts are returned to the states for distribution. The distribution includes the introduction of the standards and specifications into the Field Office Technical Guide). In addition, they are supplied to ES and state agency field personnel.

The standards and specifications are then used in training sessions conducted for field personnel from all respective agencies. Following the training sessions they can be used in consultations with individual landowners by ES, SCS, Soil and Water conservation Districts, State Department of Agriculture and respective water quality agencies in each state.

In Section 3.3 the prototype standards and specifications developed by each state are provided.

3.3 PROTOTYPE STANDARDS AND SPECIFICATIONS

3.3.1 CALIFORNIA

NUTRIENT MANAGEMENT (acre)

DEFINITION

Managing the amount, source, form, placement, and timing of applications of plant nutrients such as nitrogen, phosphorus, potassium, and other elements needed for plant growth and crop production.

PURPOSE

To supply adequate plant nutrients for the optimum (maximum economic) crop yield, minimize entry of nutrients to surface and ground water, and to maintain or improve chemical and biological conditions of the soil. Includes managing all sources of plant nutrients such as organic wastes, chemical fertilizer, soil reserves, and crop residue.

CONDITIONS WHERE PRACTICE APPLIES

On all lands within an identified ground water or surface water quality concern area where plant nutrients are applied.

PLANNING CONSIDERATIONS

Determine if the field/CTU is located in a nutrient water resource concern area, either ground water or surface water quality, by referring to the County Resources Inventory Water Quality maps.

Review the list of Nitrogen and Phosphorus fertilizers being used in your county/field office area with the land user/producer to identify any being used and their amounts and application schedules.

Where ground water is the resource concern, determine the potential loss of nitrate Nitrogen due to leaching:

Find the leaching potential for each soil mapping component from the soil ranking tables in the FOTG.

If the soil mapping component has a slope greater than 5 percent, reduce the soil surface loss potential by one unit, i.e. INTERMEDIATE to NOMINAL.

If potential is NOMINAL, the fertilizer could be used with little hazard to the respective water resource.

If the potential is INTERMEDIATE, the fertilizer has the possibility of being lost to leaching and additional site evaluation is needed. Consider split applications and changing the time interval between applications and irrigations or rainfall events.

If potential is HIGH, nitrate fertilizer applied on this soil has a high probability of being lost to leaching. Develop a nutrient budget for Nitrogen for the proposed cropping sequence. Consider substitution of other Nitrogen fertilizers - ammonium forms, split applications, reducing the rates, and changing one of the crops.

Where surface water is the resource concern, determine the potential loss of Phosphorus due to surface runoff:

Find the soil surface loss potential for each soil mapping component from the soil ranking tables in the FOTG.

If the soil mapping component has a slope equal or less than 2 percent, reduce the soil surface loss potential by one unit, i.e. INTERMEDIATE to NOMINAL.

If potential is NOMINAL, the fertilizer could be used with little hazard to the respective water resource.

If potential is INTERMEDIATE the fertilizer has the possibility of being lost to surface runoff and additional site evaluation is needed. Consider split applications and changing the time interval between applications and irrigations of rainfall events.

If potential is HIGH, Phosphorus fertilizer applied on this soil has a high probability of being lost to surface runoff. Develop a nutrient budget for Phosphorus for the proposed cropping sequence. Consider split applications, reduced rates, and changing one crop to reduce the predicted soil loss due to rainfall or irrigation to not exceed the soil loss tolerance plus 1.0 ton for the critical soil mapping unit.

Plan erosion control practices to minimize soil loss and runoff that can carry dissolved and attached nutrients to surface waters.

Management practices such as winter cover crops can be used to take up excess plant nutrients to prevent their movement out of the root zone during the nongrowing season.

Prevention of excessive or luxury levels of P and K in the soil will tend to avoid induced deficiencies of several micronutrients.

Maintain proper soil pH for optimum utilization of applied nutrients.

In establishing proper application rates and balance of nutrients:

Soil test recommendations or plant tissue tests should be used for determining application rates.

Realistic yield goals should be based upon soil type, available moisture, historical yield data, climatic conditions, and fertilizer costs versus returns.

Maintenance of good soil tilth will make plant nutrient absorption more efficient reducing need for applied fertilizer to compensate for poor root development.

Form of fertilizer and its timing, placement, and method of application can be manipulated to conform to seasonal variation in plant uptake needs, reduce soil fixation, and avoid excessive soil-water solution nutrient concentrations that could leach out of the root zone when the soil moisture holding capacity is exceeded.

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Refer to the National Agricultural Waste Management Field Manual for guidance concerning animal waste utilization.

OPERATION,SAFETY AND MAINTENANCE

Calibrate application equipment to ensure applied rates are within ±10 percent of the recommended rates.

Avoid unnecessary exposure to chemical fertilizers and organic wastes. Wear protective clothing, respirator, gloves, and footwear when appropriate.

When cleaning equipment after nutrient application, remove and save fertilizers or wastes in appropriate manner. If system is flushed, be sure waste water is kept away from high runoff areas, ponds, lakes, streams, and other water bodies.

Dispose of fertilizer containers in an approved manner, according to local or state regulations.

SPECIFICATION GUIDE

Specify the kind and amount of plant nutrients required to meet the crop fertility needs, the placement and timing where appropriate, the crop and cropping sequence, frequency of soil tests or plant tissue tests, and the necessary operations, safety and maintenance needed. Specifications shall be consistent with all state and local regulations.

PESTICIDE MANAGEMENT (acre)

DEFINITION

Managing the type, amount, placement, and timing of applications of pesticides needed for plant growth or crop production.

PURPOSE

To control target plant and animal pests and minimize contamination of soil, water, air, and nontarget plants and animals through safe and prudent use of pesticides.

CONDITIONS WHERE PRACTICE APPLIES

On all lands and water within an identified ground water or surface water quality concern area where pest control is needed and where control of pests by other means in not feasible.

PLANNING CONSIDERATIONS

Determine if the field/CTU is located in a pesticide water resource concern area, either ground water or surface water quality, by referring to the County Resources Inventory Water Quality maps.

Review the list of target pesticides developed for your county/field office area with the land user/producer to identify any being used and their application schedules.

Where ground water is the resource concern, determine the potential pesticide loss to leaching for each targeted pesticide being used:

Find the leaching potential for each soil mapping component from the soil ranking tables in the FOTG.

Determine the pesticide leaching potential from the pesticide properties in the Pesticide Data Base in the FOTG.

Use these ratings with the POTENTIAL PESTICIDE LOSS TO LEACHING MATRIX (FIGURE 1) to determine Potential 1, 2, or 3.

FIGURE 1. POTENTIAL PESTICIDE LOSS TO LEACHING MATARIX

Soil leaching potential	Pesticide leaching potential			
	Large	Medium	Small	Total Use
High	Potential 1	Potential 1	Potential 2	Potential 3
Intermediate	Potential 1	Potential 2	Potential 3	Potential 3
Nominal	Potential 2	Potential 3	Potential 3	Potential 3

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Where surface water quality is the resource concern, determine the potential pesticide loss to surface runoff for each targeted pesticide being used:

Find the soil surface loss potential for each soil mapping component from the soil ranking tables. If the soil has a slope equal or less than 2 percent, reduce the soil surface loss potential by one unit, i.e. INTERMEDIATE TO NOMINAL.

Determine the pesticide surface loss potential from the pesticide properties in the Pesticide Data Base in the FOTG.

Use these ratings with the POTENTIAL PESTICIDE LOSS TO SURFACE RUNOFF MATRIX (FIGURE 2) to determine Potential 1, 2,or 3.

Potential 3: This pesticide applied on this soil has very low probability of being lost to surface runoff or leaching. This pesticide could be used according to label with little hazard to the respective water resources.

Potential 2: This pesticide applied on this soil has the possibility of being lost to surface runoff or leaching. However the possibility of loss is not as great as Potential 1. The effect of the pesticide on the water resource will need additional site evaluation.

Potential 2 guidelines differ from Potential 1 in: (1) the pesticide surface loss potential may be reduced one rank, i.e. LARGE TO MEDIUM, if foliar applied, incorporated, or banded under the surface, (2) the pesticide leaching potential could be reduced one rank if foliar applied, and (3) the use of this pesticide on this soil could be considered similar to potential 3 if the rainfall probability is low.

Potential 1: This pesticide applied on this soil has a high probability of being lost to surface runoff or leaching. Before deciding to use Potential 1 pesticides, they should be evaluated for their health hazard to humans and animals. If a pesticide is a potential danger to health, an alternative pesticide, or other pest management techniques should be selected.

If the pesticide poses a potential problem to a water resource, the land user/producer should consider such items as: (1) crop management techniques such as rotations, and be

FIGURE 2. POTENTIAL PESTICIDE LOSS TO SURFACE RUNOFF MATRIX

Soil surface loss potential	Pesticide surface loss potential		
	Large	Medium	Small
High	Potential 1	Potential 1	Potential 2
Intermediate	Potential 1	Potential 2	Potential 3
Nominal	Potential 2	Potential 3	Potential 3

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referred to consult with a licensed PCA and Farm Advisor for (2) alternative pesticides, (3) alternative pesticide application techniques, and (4) biological control such as insect attractant traps.

Encourage the use of integrated pest management (IPM) systems that utilize the most appropriate means of pest control including cultural, mechanical, biological and chemical methods.

Encourage field scouting of pests to determine when the treatment threshold has been reached. Treatment thresholds for specific insects and crops are available from Farm Advisors. Uneconomic and environmentally unneeded application of pesticides can thus be avoided.

Field applications of pesticides should be forgone just prior to predicted heavy rainfalls to prevent surface water contamination and ineffective control of target plants and animals.

Consider crop rotation and varietal resistance as a part of the integrated pest management system. This will remove or reduce pesticide availability as a potential pollutant of water.

Plan erosion control practices to minimize soil loss and runoff that can carry dissolved and adsorbed pesticides to surface waters.

OPERATION,SAFETY AND MAINTENANCE

The pesticide user should be encouraged to:

Be fully trained and licensed or certified to apply restricted use pesticides.

Read and follow all label directions and Material Safety Data Sheets (MSDS).

Calibrate application equipment to ensure applied rates are within ±10 percent of the recommended rates. Replace worn nozzle tips, cracked hoses, and faulty gauges.

Clean application equipment after each use by triple rinsing according to state and local regulations.

Always store pesticides in the original labeled containers, preferably in a locked building with appropriate warning signs.

Dispose of leftover material and containers according to label requirements. Never reuse pesticide containers for any purpose other than to return to manufacturer.

Avoid exposure to pesticides. Wear appropriate protective clothing, respirator, gloves, and footwear when appropriate. Bathe after possible dermal exposure and prior to dining or smoking. Oral or inhalation of pesticides require immediate first aid measures and assistance of a poison control center or doctor.

Avoid drift. Apply pesticides when wind speeds are below 5 mph.

Check product label and adhere to field reentry time.

Be absolutely sure, if pesticide is applied by a custom applicator or an employee who is not the decision maker, that they are aware of the exact location and area to treat.

SPECIFICATION GUIDE

Specify the target pests and alternative control methods.

Specify that the land user/producer is to obtain detailed specifications for each pesticide used, rates, timing, and methods of application from a Pest Control Advisor (PCA) licensed by the California Department of Food and Agriculture.

Also include the necessary operations, safety and maintenance items needed.

Specifications shall be consistent with all state and local regulations.

3.3.2 ILLINOIS

PRACTICE NAME: Nutrient Management (Acres)

DEFINITION:

Managing the amount, source, form, placement, and timing of applications of plant nutrients for crop production.

PURPOSE:

To supply adequate plant nutrients for optimum crop yield, minimize potential for entry of nutrients into surface water and ground water, and to maintain or improve chemical and biological condition of the soil. Includes managing all sources of plant nutrients, such as soil reserves, chemical and organic fertilizer, crop residue, legumes, agricultural wastes, and municipal and industrial wastes.

CONDITIONS WHERE PRACTICE APPLIES:

On all lands where plant nutrients are applied for crop production.

PLANNING CONSIDERATIONS:

1. Effects on Water Quality - Reduce the potential for pollution of surface water and/or ground water (see Section I of the Field Office Technical Guide (FOTG) for the major water resource concerns) by plant nutrients (principally phosphorous and/or nitrogen) by limiting the amount applied to the soil to that needed to maintain soil fertility levels and to produce a crop consistent with realistic production goals (ref 1) and based on the potential productivity of the soil (ref 4).

2. All sources and forms of plant nutrients available for plant growth shall be considered in developing a nutrient management plan. Develop a nutrient budget (Appendix A) for the proposed crop by testing for or estimating the present residual amount in the soil and in previous crop residue, then adding the amounts of nutrients supplied from applications of other organic materials, and chemical fertilizer.

3. The efficient utilization of plant nutrients requires that all plant nutrients be supplied in adequate amounts. For example, adequate levels of P and K help protect the environment from carryover nitrate accumulations and potential movement to the groundwater (ref 3).

4. Establish proper application rates of nutrients consistent with Cooperative Extension Service or other soil test recommendations based on regular soil test results, setting realistic yield goals, and considering all sources of nutrients available to the crop. Results obtained from use of soil test procedures that have been calibrated for the soil types, when combined with realistic yield goals, will provide for fertilizer recommendations for optimum crop production and minimum potential for degradation of water quality (ref 1).

5. Nitrogen and phosphorous are critical nutrients in planning for water quality. Timing, placement, method of application, and form of fertilizer are important considerations for managing these nutrients (ref 1).

6. Prevention of excessive or luxury levels of P and K in the soil will tend to avoid induced deficiencies of several micronutrients (ref 1).

7. Maintain proper pH for optimum utilization of available nutrients. Table 1 in Appendix A lists the optimum pH range for crops commonly grown in Illinois. Optimum pH ranges for crops not given in the table can be obtained from the Cooperative Extension Service (ref 1).

8. Plan erosion control practices to minimize soil loss and runoff that can carry dissolved and attached nutrients to surface waters. This is especially important where soils contain high levels of phosphorous (P) and potassium (K).

9. Maintenance of good soil tilth will make nutrient uptake more efficient, and thus reduce the need for additional fertilizer to compensate for poor root development.

10. During years of normal fertilizer application and unexpected low yields, excess nutrients may accumulate in the soil. In these years management practices, such as winter cover crops, should be used to utilize surplus nutrients and prevent their movement to below rooting zone or movement to surface waters. (Use cover crops where adequate soil moisture is available or can be added and the remainder of the growing season is sufficiently long for sufficient growth of the cover crop).

11. Organic wastes, such as animal manures, municipal wastes, cannery wastes, etc., are a source of plant nutrients. The National Agriculture Waste Management Field Manual (ref 2) and state and local regulations provide guidance concerning utilization of these sorces of nutrients.

SPECIFICATIONS:

1. Base nutrient application rates on soil test results, on realistic yield goals, and consider all sources of nutrients that will be available for plant growth and production (ref 1).

2. Assess on-farm generated wastes for nutrient content based on the livestock species and class and on the waste storage and handling methods. Waste from liquid manure systems shall be analyzed after initial start-up to establish a trend in nutrient content and tested again after any changes in livestock or feeding that would cause a change in nutrient composition (ref 2).

3. Select and document the nutrient application method and time the application of nutrients to provide optimum nutrient availability to the crop and to minimize nutrient loss and/or degradation of the environment (ref 1, Appendix A).

4. Use erosion control practices in conjunction with nutrient management principles to minimize soil loss and runoff that can carry sorbed nutrients to the water resource.

5. Add liming materials according to soil test recommendations.

OPERATION, SAFETY, AND MAINTENANCE:

1. Maintenance and operation of equipment are important to assure that planned application rates are properly applied. The equipment should be calibrated to manufacturers specifications..

2. Avoid unnecessary exposure to chemical fertilizers and organic wastes. Wear protective clothing, respirator, gloves, and footwear when handling potentially dangerous materials.

3. When cleaning equipment after nutrient application, remove or save excess material in an appropriate manner. Waste water resulting from flushing the equipment, should be kept away from wells, surface water bodies, sinkholes, and high runoff areas.

4. Dispose of product containers in an approved manner and according to local and/or state regulations.

5. Follow local, state, and federal regulations regarding the transport of fertilizers.

REFERENCES

1. Illinois Agronomy Handbook; current year; Cooperative Extension Service, University of Illinois

2. National Animal Waste Management Field Manual; 1975; USDA-Soil Conservation Service

3. N,P, & K: Partners in Corn Production Efficiency; Pamphlet; 11 p.; Potash & Phosphorous Institute; Pamphlet; Atlanta, GA.

4. Soil Productivity in Illinois, C1156; 1978; Cooperative Extension Service, University of Illinois. College of Agriculture

5. Nitrogen-Loss Potential Ratings for Illinois Soils; 1989; Ill. Agric. Exp. Sta. Bull. 784.

APPENDIX A

Nutrient applications are based on crop needs for realistic yield goals for the crop to be produced. Unrealistic yield goals can result in excess nutrient application resulting in unnecessary production costs and an increased risk for water quality degradation.

Applied nutrients are lost from the rooting zone by leaching to below the rooting zone, by being removed from the field in surface runoff, or by volatilization into the atmosphere. Of the most commonly applied nutrients, nitrogen has the highest potential for leaching to below the rooting zone and to loss by volatilization into the atmosphere. Phosphorous and potassium adhere strongly to soil particles and are lost primarily as suspended sediment in surface runoff.

Nutrients should not be applied in late fall or winter when soils are frozen or covered with ice or snow. Fall applications that are not incorporated into the soil should not be applied where the slope exceeds about 4% unless runoff control measures, such as heavy residue cover, contour mulch tillage, contour strip cropping, or terraces, have been applied.

The leaching index described later in this Appendix can be used to evaluate the potential loss of soluble nutrients by leaching below the root zone. Plant nutrients may be applied as broadcast, starter, surface band other than starter, or injected band applications. Any one method may have its advantages under a given set of circumstances (ref 1).

The loss of nitrogen from the soil depends on the climate, soil, type of nitrogen fertilizer, and the application program. Normally, with adequate soil moisture, nitrogen loss potential can be reduced by applying nitrogen fertilizer close to the time of greatest crop demand. The following table along with soils information for the field will help to identify the potential hazard for nitrogen loss by leaching. (More detailed information on total nitrogen loss potential is available in the University of Illinois Agricultural Experiment Station Bulletin 784, Nitrogen-Loss Potential Ratings for Illinois Soils.)

Nitrogen Leaching Potential[1] by Application Method
for Coarse, Medium, and Fine Textured Soils

	Soil Texture[2]		
	Coarse	Medium	Fine
Fall applied	H-M	M-L	L
Spring applied, preplant	H-M	M-L	L
Sidedress or split appl.	M-L	L	L

[1] Potential Ratings: H - High probability for leaching loss
M - Moderate probability for leaching loss
L - Low probability for leaching loss

[2] Soil Texture: Coarse - sand, loamy sand, sandy loam
Medium - silt, silt loam, loam
Fine - silty clay loam, silty clay, clay, clay loam, sandy clay loam, sandy clay

General Guidelines: Given the same climatic conditions, the more permeable the soil and the greater the time between application and plant utilization, the greater is the potential for leaching loss. Therefore,

.Use sidedress or split application programs on coarse textured soils.

.Use spring and sidedress or split applications on medium textured soils.

.Avoid using nitrogen sources which contain nitrate nitrogen when conditions indicate a medium or high loss potential.

.Use nitrification inhibitors with ammonium forming fertilizers in those conditions where nitrogen loss potential is moderate or high. In fall application programs use inhibitors when soil temperature at the 4-inch depth is 50 to 63 degrees F.

TABLE 1. Soil pH Range for Production of Common Crops *

ANNUAL CROPS:		PERENNIAL CROPS:	
Barley	5.0-8.5	Alfalfa	6.5-8.5
Corn	5.0-7.5	Birdsfoot Trefoil	5.5-6.5
Oats	5.0-8.5	Clover, Alsike	4.0-7.5
Rye	4.0-6.5	Ladino	5.5-7.5
Ryegrass, ann	5.0-6.5	Red	6.5-7.5
Sorghums	5.0-7.5	White	5.5-7.5
Soybeans	5.5-7.5	Crownvetch	5.5-8.5
Sudangrass	5.0-7.5	Fescue grasses	5.0-6.5
Wheat	5.0-8.5	Kentucky Bluegrass	5.0-8.5
		Orchardgrass	5.0-7.5
		Redtop	4.0-7.5
		Reed Canarygrass	5.0-7.5
		Ryegrass, perenn	5.0-6.5
		Smooth Bromegrass	5.0-6.5
		Sweetclover	6.5-8.5
		Timothy	5.0-7.5

* The optimum soil pH for production is near the midpoint of the H range.

NITRATE AND SOLUBLE NUTRIENT LEACHING INDEX (LI)

This section provides a method to determine the degree to which water percolates below the root zone in certain soils. Percolation water containing dissolved nitrates or other soluble nutrients could be a hazard to ground water. The method is based on a LI.

For areas with ground water concerns (see Section I of the FOTG to determine the water resource concern), the LI should be determined to evaluate the potential for contaminating the ground water with soluble nutrients. The LI uses annual precipitation, hydrologic soil group, and rainfall distribution data.

Leaching index:

A LI map for each hydrologic soil group is in Section IB of the FOTG. The hydrologic group for each of the LI maps describe those soils that do not have dual hydrologic ratings because of differences in drainage. Soils with dual hydrologic ratings, such as B/D, should be evaluated on the basis of the current drainage status of the soil in each field. If the soil has a high LI rating, soluble nutrients--especially nitrates--may leach to below the rooting zone and may contaminate the ground water.

The LI does not account for irrigation. If irrigation is applied only to supply plant needs, there will be little additional loss to below the rooting zone. The additional loss would be relative to the precipitation events after the soil profile is saturated or nearly saturated due to irrigation or rainfall.

Procedure:

The following steps can be used to determine the leaching index of a certain soil and to document the determination:

1. Determine the dominant soil types in the field and list on the Worksheet for Determining Leaching Index Potential for Developing Nutrient Management Strateties.

2. From the LI soil legend (Table 2 or Section IID of the FOTG), find the hydrologic group for the soil(s). For soils with dual hydrologic groups, the drainage status of the soil in the field also needs to be determined.

3. From the LI soil legend, determine the Leaching Index Potential for the soil(s), and record LI potential on the worksheet.

4. From the worksheet, determine the planning soil type and develop fertility management strategies. The planning soil type will include the critical soil and soil areas, those areas with MEDIUM or HIGH LI potentials. Management strategies can be recorded in the column labled Other Considerations.

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WORKSHEET FOR DETERMINING LEACHING INDEX POTENTIAL
FOR DEVELOPING NUTRIENT MANAGEMENT STRATEGIES

Practice No._____ Narrative No._____ Units: Acres

ASCS Farm No._____ Tract No._____ Field No.(s)_____

Resource Concern: |_| Surface Water (Runoff potential-loss of P and K)
(Determine from information in Section IB of FOTG) |_| Groundwater (Leaching potential-loss of N)

Crop:_____

Planning Soil Type:_____
(from list below)

Soil Name or Symbol	Hydrologic Group	LI Value	Other Considerations*

*Other considerations:

.Any factor that may increase or decrease the expected infiltration of precipitation; i.e. tillage, residue management, contouring.

.Factors that may decrease the loss of soluble nutrients: i.e. solubility of materials, time of application along with time of maximum leaching potential. The LI is the average leaching for the year. If large amounts of precipitation fall in the winter, the majority of the leaching could be expected in winter months. The water budget in Section ID of the FOTG provides information on rainfall distribution and water utilization.

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.Geologic and water table considerations; i.e. depth to potable water source, fractured bedrock, distance to nearest well.

.Consider any factors that affect the nutrient/water balance.

DESCRIPTION OF THE LEACHING POTENTIALS AND GUIDELINES FOR RECOMMENDATIONS:

A LI of less than 2 would probably not contribute to soluble nutrient leaching below the root zone. (The adjective rating is LOW.)

A LI of between 2 and 8 may contribute to soluble nutrient leaching below the root zone and nutrient management to reduce the potential for leaching should be considered. (The adjective rating is MODERATE.)

A LI of larger than 8 has a high potential to contribute to soluble nutrient leaching below the root zone. Nutrient management practices are needed to reduce the potential for leaching. Also consider management practices that help to reduce infiltration, such as strip cropping rather than tile outlet terraces. (The adjective rating is HIGH.)

NUTRIENT BUDGET WORKSHEET

Field Number: _____ Date: _____

Dominant or Planning Soil Type: _____

Tillage Practices: _____

Previous Crop: _____ Yield: _____

Planned Crop: _____ Yield goal: _____
(5 yr. avg +5%)

Soil Test Levels: P _____ppm; K _____ppm; pH _____

Organic Waste-Nutrient Content: _____#N/ton; _____#P2O5/ton; ____#K2O/ton

-Rate to be Applied: _____ton/acre

	N/Acre	P_2O_5	K_2O
A. Amt needed for crop goal (#/Ac):	_____	_____	_____
B. Amt needed for soil build-up (#/Ac):	N/A	_____	_____
TOTAL (A + B) (#/Ac):			
C. Organic waste -(crop residue)(#/Ac):	_____	_____	_____
D. Nutrient needs (or surplus) (#/Ac): (TOTAL - C)	_____	_____	_____

Source to meet need (amounts)

Green Manure (#/Ac):	_____	N/A	N/A
Ag. Waste (#/Ac):	_____	_____	_____
Chemicals (#/Ac):	_____	_____	_____

(Nutrient value of source: ____tested; ____estimated.)

Application method to be used: _____

Application date(s): _____

.Not all of the nutrient content of manure or crop residue is available to a crop in the year of application. All of the ammonium (NH4) is available to the crop the first year after application minus losses due to storage and handling. The conversion of organic-N to

plant available forms during the first year ranges from 25-50%. The amounts released during the second, third, and fourth years after application are 50%, 25%, and 12.5%, respectively, of the amount converted the first year. Generally 80% of the phosphorous and potassium is available during the year of application.

PEST MANAGEMENT (Acres)

DEFINITION

Managing populations of weeds, insects, and diseases to an acceptable level for economical agricultural production and environmental resource protection.

PURPOSE

To develop a program to control target pests and minimize contamination of soil, water air, and non-target organisms. This includes appropriate cultural, chemical, biological, and/or natural methods.

CONDITIONS WHERE PRACTICE APPLIES

On all agricultural lands and water where control of target pests is desired.

PLANNING CONSIDERATIONS

GENERAL:

1. Use integrated pest management (IPM) systems that utilize the most appropriate means of pest control including cultural, mechanical, biological, and chemical methods.(5) Consider the following IPM guidelines:

   a. Scout to identify and analyze the pest problem(s).

   b. Evaluate pest control alternatives and select tactics that will keep pests at non-economic levels.

   c. Consider the economic, ecological, and environmental impacts of the alternatives.

   d. Use econimic thresholds, when known, to determine the need for treatment.

   e. Evaluate the effectiveness of the alternative(s) selected.

2. Effect on Water Quality - Use pest management principles to reduce the potential for pollution of surface water and groundwater by pesticides and minimize adverse impacts of cultural and biological control methods on water quality. Pest management principles, used in conjunction with erosion control practices, will minimize soil loss and runoff that can carry adsorbed or dissolved pesticides to water resources.

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3. Identify the dominant water resource concern for the area of consideration. Reference maps in section one of the field office technical guide will help you make this determination.

4. Assess the pest management methods and select a control method or a combination of control methods that have the lowest potential for adverse environmental effects on the resource of primary concern.

SELECTION OF METHOD:

Figure one is intended to be used as a guide to evaluate the potential environmental impacts of the three types of pest control methods on the major resources. Generally, pest control methods that have a low (L) potential effect on the resources are the preferred control methods and no further evaluation is needed. Pest control methods with moderate (M) or high (H) potential will require further evaluation of the control method or the resource of concern.

Figure 1. APPRAISAL OF ENVIRONMENTAL IMPACTS OF PEST MANAGEMENT METHODS ON RESOURCES

Control Method	Resource Concern						
	Soil		Water		Air	Biological Diversity	Econ.
	E*	C#	Surface	Ground			
Cultural	L-H	L	L-H	L	L-M	L-H	L-H
Biological	L	L	L	L	L	L-H	L-M
Chemical	L	M-H	H	H	H	H	M-H

POTENTIAL FOR CONTAMINAATION OF RESOURCE
L = Low potential
M = Moderate potential
H = High potential

*E = erosion (tons): L = < 3 M = 3 - 10 H = > 10
#C = contamination of soil.

CULTURAL AND MECHANICAL CONTROL METHODS:

1. Use good cultural practices that include adequate seedbed preparation, adequate fertilization, crop rotation, planting on the proper date, use of optimum row width, and seeding at the rate required for optimum stands to aid in weed control.

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2. Plant in relatively warm soil to help the crop emerge quickly and compete better with weeds.

3. Plant in narrow rows where weed pressure is light so the crop rows will shade the centers faster and help the crop compete with weeds, but where weed pressure is greater, plant rows wide enough to allow for cultivation.

4. Rotate crops to disrupt the life-cycle of insect pests and crop diseases.

BIOLOGICAL CONTROL METHODS:

1. Use resistant varieties to avoid injury by certain insect pests and crop diseases.

2. Encourage propagation of desirable insects.

CHEMICAL CONTROL METHODS:

1. Refer to the Illinois Pest Control Handbook, current year, (1) for the latest pesticide recommendations and toxicity information. Some pesticides have been designated as restricted use pesticides by the US EPA, and require the user to be certified by the Illinois Department of Agriculture to purchase and apply these products.(3)(4) Some pesticide labels carry groundwater warnings under the environmental hazard or the groundwater advisory sections of the label. Growers are advised not to apply these pesticides where the soils are very permeable or where the water table is close to the surface.

2. Select pesticides based on characteristics such as solubility, toxicity, volatility, degradation, and adsorption, (1) (Appendix B) along with evaluation of site characteristics such as soil, geology, depth to water table, proximity to surface water, topography, and climate.

3. Use options, such as banding of chemicals, post-emergent treatment, and split application, when feasible, to control crop pests, to reduce pesticide usage and minimize impacts on water quality.

SPECIFICATIONS

1. Cultural and Mechanical Control Methods:

   a. General
      (1) Rotate crops with different growth habits or life cycles to interrupt the life cycle of weeds, insects, or diseases.
      (2) Utilize timely planting dates to optimize crop competition and minimize pest infestations.

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b. Weeds
   (1) Use clean seed to prevent weeds from being introduced.
   (2) Utilize crop competition where appropriate to suppress weeds.
   (3) Use companion crops to provide weed competition until the desired crop is established.
   (4) Use cover crops and crop residues for their mulching and alleopathy effect to suppress weed growth.
   (5) Use crop cultivation and shallow tillage operations to control annual and biennial weed seedlings.
   (6) Mow at the proper time to prevent reseeding of all weeds, and to have maximum impact on the root reserves of perennial weeds.
   (7) Utilize timely harvest schedules to control weed seed production.
   (8) Use clean feed supplies for livestock to prevent spreading weed seed.
   (9) Control weeds on reinfestation sites.

c. Insects
   (1) Time harvest to minimize losses from insects.
   (2) Control alternative host plants.
   (3) Remove existing infestations or destroy the habitat necessary for a pest buildup.

d. Diseases
   (1) Use disease free seed when available.
   (2) Provide proper nutrients, water, pH, and soil conditions that favor vigorous growth to reduce stress on plants.
   (3) Remove infected plants or plant parts, or bury or incorporate diseased plant parts by use of tillage practices.
   (4) Treat soil and plant parts with heat or fumigants to destroy disease organisms in cases of severe economic impacts.

2. Biological Control Methods:

a. Weeds
   (1) There are no known successes with classical biological control of row crop weeds in Illinois.

b. Insects
   (1) Utilize and protect the natural enemies of insect pests.
   (2) Use resistant varieties.

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c. Diseases
   (1) Use organisms that are antagonistic to the disease.
   (2) Use resistant varieties.

3. Chemical Control Methods:

a. General
   (1) Select a pesticide suggested by the Illinois Cooperative Extension Service for your crop and pest problem.(1)
   (2) Select a pesticide from the suggested alternatives that has the lowest potential loss rating on your soils. (Appendix A)
   (3) Reduce pest resistance and carryover potential by using the lowest rate practical,applying uniformly, rotating pesticides to avoid repeated use of pesticides with similar modes of action, and using spot treatment when possible in preference to whole field application.
   (4) Do not apply pesticides that carry groundwater warnings under the environmental hazard or the groundwater advisory sections of the label to soils that have rapid or very rapid permeability, or that have a water table close to the surface.
   (5) Use erosion control practices in conjunction with pest management principles to minimize soil loss and runoff that can carry adsorbed pesticides to the water resource.

b. Weeds
   (1) Determine herbicide rates in consideration of weed species and/or stage of growth.

c. Insects
   (1) Select insecticides that impose the least risk to beneficial insects and to the environment.

d. Diseases
   (1) Use pesticides to protect the host plant before it is infected.
   (2) Use pesticides to eradicate the pathogen after it has infected the host plant.

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ENVIRONMENTAL EVALUATION OF PESTICIDES

Once a decision has been made to use a chemical pest control method, selection of the products will be made. Where a water resource concern has been identified, the pesticide selected should be evaluated for its potential to run off or leach from the application area. Pesticide evaluation ratings may be determined from the guidelines in Appendix A. The ratings, stated as soil-pesticide interaction ratings, help determine the potential for pesticide loss from surface runoff and from leaching or percolation below the root zone when a specific pesticide is used on a specific soil.

OPERATION, SAFETY, AND MAINTENANCE CONSIDERATIONS FOR PESTICIDES

1. The pesticide user must be fully trained, and be licensed by the Illinois Department of Agriculture to purchase and apply restricted use pesticides in Illinois.

2. Read and follow all label directions. Take appropriate precautions to protect non-target organisms such as fish, honeybees, and ornamental plants.(1)

3. Calibrate application equipment before each seasonal use. (1 pp. 361-390) Replace worn nozzle tips, cracked hoses, and faulty gauges.

4. Avoid exposure to pesticides.(1 pp. 199-215) Wear protective clothing, respirator, gloves, and footwear when appropriate. Bathe after exposure and prior to eating, drinking, or smoking.

5. Know what to do in case of accidental pesticide poisoning. Have a pesticide first aid kit readily available. Check the product label for instruction and call the nearest poison center in the event a pesticide is swallowed.

6. Delay application of pesticides when heavy rains are forecast to prevent contamination of surface water or groundwater resources from runoff or leaching.

7. Accurately measure and mix all pesticides, and accurately measure all fields. Use only the amount needed to eliminate having to store or dispose of any excess.

8. Mix and load pesticides away from natural runoff areas, and at least 200 feet away from wells, creeks, ponds, or natural watercourses.

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9. Prevent back-siphoning of the pesticide mixture into the water supply. When adding water to spray tanks, keep an air space between the water supply hose and the top of spray tank. When using chemigation, use a back-siphoning check valve.

10. Empty the water used to rinse pesticide containers into the spray tank.

11. Clean application equipment at a suitable site after each use. Rinse water should not flow off the cleaning site. This site should be rotated so as to avoid build-up of pesticide in the soil, and should not be within 200 feet of wells, creeks, ponds, or natural watercourses.

12. Be absolutely sure that the person who is applying the pesticide knows the exact location and area they are to treat.

13. Avoid drift when spraying by applying pesticides when wind speeds are below 8 to 10 mph, and the wind direction is away from susceptible crops, landscaping plants, residences, and livestock quarters.

14. Check the product label or Worker Protection Rules (Appendix D) for field worker re-entry times and strictly adhere to them.

15. Dispose of leftover material and containers according to label requirements, never re-use pesticide containers for any other purpose, and do not dispose of waste material in unused wells, sinkholes, or other routes to groundwater or surface water.

16. Pesticides should be stored in the original labeled containers, preferably in a locked building, with appropriate warning signs inside the buildilng. They should not be stored near wells or other water sources.

17. The farm operator should maintain accurate records of the name, location, and date of chemical pesticides used.

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REFERENCES

1. Illinois Pest Control Handbook (Current Year): Cooperative Extension Service, University of Illinois

2. Illinois Agronomy Handbook (Current Year): Cooperative Extension Service, University of Illinois

3. Illinois Pesticide Applicator Study Guide (Revised); General Standards Training Manual for Private and Commercial Pesticide Applicators and Operators; SP 39, University of Illinois

4. Illinois Pesticide Applicator Training Manual; Field Crops; SP 39-2, University of Illinois

5. Integrated Pest Management. Bottrell, Dale R.; December 1979: Council on Environmental Quality

6. Equipment and Calibration: Low-Pressure Sprayers, C1192, University of Illinois

7. Equipment and Calibration: Granular Applicators, C1240, University of Illinois

8. Managing Pesticides for Water Quality Protection; 1989; Environmental Engineering Technical Note No._____; U.S. Soil Conservation Service.

9. Agrichemical Manual; 1989; U.S. Soil Conservation Service.

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APPENDIX A

SOIL-PESTICIDE INTERACTION RATINGS

INTRODUCTION:

Soil-pesticide interaction ratings help determine the potential for pesticide loss from surface runoff and from leaching or percolation below the root zone when a specific pesticide is used on a specific soil. This rating procedure only provides information to determine relative risks to water resources. The estimates of risk to water resources in the data base or derived from the data base should not be considered precise--there are too many variables involved. The estimates of risk should be considered a first approximation and a guide for better management.

SOIL AND PESTICIDE RANKING:

Soils are ranked in Table 2 according to potential for pesticide loss from surface runoff and from leaching. Soils ranking tables are also in section IIA of the field office technical guide (FOTG). The tables list the soil series, surface loss potential, and leaching potential. The soil surface loss potential and soil leaching potential are ranked as high, intermediate, or nominal.

Pesticides in Table 1 are ranked according to potential for loss to surface runoff and leaching. The pesticide ranking tables are also in section IA of the FOTG. The tables list the pesticide properties that include the surface loss potential and leaching potential of each pesticide. The surface loss potential is ranked as large, medium, or small. The leaching potential is ranked as large, medium, small, or very small.

The user should determine the water resource concern (e.g. ground water or surface water quality) from reference maps in Section IA of the FOTG, then select the appropriate procedure to determine the potential pesticide loss. The respective procedure determines the potential loss of a pesticide to leaching or to surface runoff when used on a particular soil.

PROCEDURE:

Both the pesticide rank and the soil rank are used to determine the potential for pesticide loss to surface runoff or to leaching. Follow these steps:

Potential Pesticides Loss to LEACHING:

1. Find the leaching potential for the soil or map unit from the soil ranking in Table 2.

2. Determine the pesticide leaching potential from the pesticide properties in Table 1.

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3. Use these ratings with the potential pesticide loss to leaching matrix (fig. 1) to determine the potential 1, 2, or 3.

Using the Matrix: The intersection of the soil leaching potential and the pesticide leaching potential gives the overall leaching potential--a potential 1, 2, or 3. For example, a soil with an intermediate soil leaching potential and a pesticide with a small leaching potential will rate as "Potential 3", shown below in bold type.

Figure 1. Potential pesticide loss to leaching matrix

Soil leaching potential	Pesticide leaching potential			
	Large	Medium	Small	Very Small
High	Potential 1	Potential 1	Potential 2	Potential 3
Intermediate	Potential 1	Potential 2	**Potential 3**	Potential 3
Nominal	Potential 2	Potential 3	Potential 3	Potential 3

Potential Pesticide Loss to SURFACE RUNOFF:

1. Find the soil surface loss potential for the soil series from the soil rankings in Table 2. Some ratings will need adjustments based on local conditions as noted in footnotes to the table.

2. Determine the pesticide surface loss potential from the Pesticide Data Base in Table 1.

3. Use these ratings with the Potential pesticide loss to surface runoff matrix (fig. 2) to determine the Potential 1, 2, or 3.

Figure 2. Potential pesticide loss to surface runoff matrix

Soil surface loss potential	Pesticide surface loss potential		
	Large	Medium	Small
High	Potential 1	Potential 1	Potential 2
Intermediate	Potential 1	Potential 2	Potential 3
Nominal	Potential 2	Potential 3	Potential 3

DEFINITIONS

Potential 1: This pesticide applied on this soil has a high probability of being lost to surface runoff or leaching. Avoid the use of Pesticides that give a Potential 1 rating. Consider an alternative pesticide, or other pest management techniques.

Potential 2: Potential 2 is an intermediate rating. This pesticide applied on this soil has the possibility of being lost to surface runoff or leaching, however, the possibility of loss is not as great as Potential 1. The effect of the pesticide on the water resource will need additional site evaluation. Although this intermediate loss group has the potential for unacceptable losses, the losses may be reduced to acceptable levels by management.

Potential 3: This pesticide applied on this soil has a low probability of being lost to surface runoff or leaching. This pesticide could be used according to label with little hazard to the respective water resource.

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DESIGN SHEET FOR CHEMICAL CONTROL METHOD OF PEST MANAGEMENT

Practice No. _____ Narrative No. _____ Units: Acres

ASCS Farm No. _____ Tract No. _____ Field No. (s) _____

Resource Concern: ☐ Surface Water (Runoff potential)
☐ Groundwater (Leaching potential)

Crop: _____ Target Pest(s) _____

Planning Soil Type: _____ Soil Loss Potential: _____

Pesticide Choices (from Illinois Pest Control Handbook, or Illinois Agronomy Handbook)

	Product	Application Method	Effectiveness Rating
1.			
2.			
3.			
4.			
5.			
6.			

Pesticide Potential Rating for water resource concern:

	SURFACE LOSS POTENTIAL	LEACHING POTENTIAL
1.		
2.		
3.		
4.		
5.		
6.		

SOIL-PESTICIDE INTERACTION RATING

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

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APPENDIX A EXAMPLE 2 Illinois Draft
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DESIGN SHEET FOR CHEMICAL CONTROL METHOD OF PEST MANAGEMENT

Practice No. _____ Narrative No. 1 Units: Acres

ASCS Farm No. 1234 Tract No. 150 Field No. (s) 1,3

Resource Concern: ☑ Surface Water (Runoff potential)
☐ Groundwater (Leaching potential)

Crop: Corn Target Pest(s) Velvetleaf

Planning Soil Type: 14C2 Soil Loss Potential: Intermediate

Pesticide Choices (from Illinois Pest Control Handbook, or Illinois Agronomy Handbook)

	Product	Application Method	Effectiveness Rating
1.	Atrazine	Postemergence	G
2.	Bladex	Postemergence	F-G
3.	Banvel	Postemergence	F
4.	2,4-D	Postemergence	G
5.			
6.			

Pesticide Potential Rating for water resource concern:

	SURFACE LOSS POTENTIAL	LEACHING POTENTIAL
1.	Medium	
2.	Medium	
3.	Small	
4.	Medium	
5.		
6.		

SOIL-PESTICIDE INTERACTION RATING

1. 2
2. 2
3. 3
4. 2
5. _____
6. _____

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Table 1. Potential for Movement of Pesticides

Part A: Herbicides

Trade Name	Common Name	Leaching Potential	Runoff Potential
2,4-D	2,4-D Sol. amine salt	medium	medium
2,4-DB	2,4-DB Ester	small	medium
Amiben	chloramben	large	small
Assure	quizalofop	small	large
Atrizine	atrizine	large	medium
Banvel	dicamba	large	small
Basagran	bentazon	medium	small
Bladex	cyanazine	medium	medium
Blazer	acifluorfen	medium	medium
Buctril	bromoxynil ester	small	medium
Classic	chlorimuron-ethyl	large	small
Command	clomazone	large	medium
Dual	metolachlor	medium	medium
Eradicane	EPTC plus safener	medium	medium
Fusilade	fluazifop-P-butyl	small	large
Gramoxone	paraquat dichloride sol. salt	small	large
Lasso	alachlor	medium	medium
Lexone	metribuzin	large	medium
Lorox	linuron	medium	large
Poast	sethoxydim	small	small
Princep	simazine	large	medium
Prowl	pendimethalin	small	large
Ramrod	propachlor	small	medium
Reflex	fomesafen sodium salt	large	medium
Roundup	glyphosate amine sol. salt	small	large
Scepter	imazaquin sol. ammonium salt	large	small
Sencor	metribuzin	large	medium
Sonalan	ethalfluralin	small	large
Sutan+	butylate plus safener	small	medium
Tandem	tridiphane	small	large
Treflan	trifluralin	small	large

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Table 1. (Cont'd.) Potential for Movement of Pesticides

Part B: Insecticides and Nematicides

Trade Name	Common Name	Leaching Potential	Runoff Potential
Aastar	flucythrinate	medium	small
Ambush	permethrin	small	medium
Broot	trimethacarb	medium	medium
Counter	terbufos	small	medium
Cygon	dimethoate	medium	small
Dyfonate	fonofos	small	medium
Furadan	carbofuran	large	medium
Lorsban	chlorpyrifos	small	medium
Malathilon	malathion	small	small
Mocap	ethoprop	large	medium
Orthene	acephate	medium	small
Penncap M	methyl parathion	very small	small
Pounce	permethrin	small	medium
Pydrin	fenvalerate	small	medium
Sevin	carbaryl	small	medium
Spectracide	diazinon	small	large
Temik	aldicarb	large	medium
Thimet	phorate	small	medium

Table 2:
Soil potential ratings for pesticide leaching loss and for runoff loss.
Effingham County, Illinois

MAPSYM	MAP NAME	LEACHING LOSS	RUNOFF LOSS
2	CISNE SILT LOAM	NOMINAL	INTERMEDIATE
3A	HOYLETON SILT LOAM, 0 TO 2 PERCENT SLOPES	NOMINAL	NOMINAL
3B	HOYLETON SILT LOAM, 2 TO 7 PERCENT SLOPES	NOMINAL	INTERMEDIATE
7C2	ATLAS SILT LOAM, 4 TO 12 PERCENT SLOPES, ERODED	NOMINAL	HIGH
7C3	ATLAS SILTY CLAY LOAM, 4 TO 12 PERCENT SLOPES, SEVERELY ERODED	NOMINAL	HIGH
8D2	HICKORY SILT LOAM, 10 TO 15 PERCENT SLOPES, ERODED	NOMINAL	INTERMEDIATE
8E	HICKORY LOAM, 15 TO 20 PERCENT SLOPES	NOMINAL	INTERMEDIATE
8F	HICKORY LOAM, 20 TO 50 PERCENT SLOPES	NOMINAL	INTERMEDIATE
12	WYNOOSE SILT LOAM	NOMINAL	INTERMEDIATE
13A	BLUFORD SILT LOAM, 0 TO 2 PERCENT SLOPES	NOMINAL	NOMINAL
13B	BLUFORD SILT LOAM, 2 TO 5 PERCENT SLOPES	NOMINAL	INTERMEDIATE
14B	AVA SILT LOAM, 1 TO 5 PERCENT SLOPES	NOMINAL	INTERMEDIATE
14C2	AVA SILT LOAM, 5 TO 12 PERCENT SLOPES, ERODED	NOMINAL	INTERMEDIATE
15B	PARKE SILT LOAM, 1 TO 5 PERCENT SLOPES	INTERMEDIATE	INTERMEDIATE
15C2	PARKE SILT LOAM, 5 TO 10 PERCENT SLOPES, ERODED	INTERMEDIATE	INTERMEDIATE
48	EBBERT SILT LOAM	NOMINAL	NOMINAL
48	EBBERT SILT LOAM	NOMINAL	NOMINAL
120	HUEY SILT LOAM	NOMINAL	NOMINAL
134B	CAMDEN SILT LOAM, 1 TO 5 PERCENT SLOPES	INTERMEDIATE	INTERMEDIATE
134C2	CAMDEN SILT LOAM, 5 TO 10 PERCENT SLOPES, ERODED	INTERMEDIATE	INTERMEDIATE
138	SHILOH SILTY CLAY LOAM	NOMINAL	NOMINAL
138	SHILOH SILTY CLAY LOAM	NOMINAL	NOMINAL
218	NEWBERRY SILT LOAM	NOMINAL	NOMINAL
225	HOLTON SILT LOAM	NOMINAL	NOMINAL
581	TAMALCO SILT LOAM	NOMINAL	INTERMEDIATE
584B2	GRANTFORK SILTY CLAY LOAM, 2 TO 5 PERCENT SLOPES, ERODED	NOMINAL	HIGH
620	DARMSTADT SILT LOAM	NOMINAL	INTERMEDIATE
W	WATER	NOMINAL	INTERMEDIATE

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APPENDIX B

PESTICIDE DATA BASE

GENERAL DISCUSSION:

The physiochemical properties of pesticides have been shown to be predictive of their environmental behavior. These properties are inherent to the pesticide molecule, but they can vary somewhat depending on the environmental conditions under which they are measured. Water solubility, soil adsorption coefficient, and vapor pressure are properties that have been correlated with the potential for pesticide runoff and leaching. Water solubility is the tendency of the pesticide molecules to disperse from one another when the chemical is placed in water. The soil adsorption coefficient reflects the tendency of the pesticide molecules to move from the soil water to the soil solids. The vapor pressure is a measure of the tendency of the pesticide molecules to escape from one another into air.

The actual amount of runoff and leaching will be controlled by the characteristics of the environment where the pesticide is applied. For example, highly water soluble chemicals tend to have very low soil adsorption coefficients and show a low propensity to adhere (ie. adsorb) to soil. A very soluble pesticide applied to a very permeable soil is very likely to leach below the root zone, which increases the risk of groundwater contamination. In contrast, pesticides with low water solubility tend to have large soil adsorption coefficients and will adhere more tightly to soil particles. These pesticides are less likely to leach, but they have a tendency to move off the field with eroding soil. Vapor pressure is a very useful property for predicting the likelihood of loss by evaporation (volatilization) from soil and leaf surfaces. Pesticides that have vapor pressure equal to or higher than 10^{-3} have a potential volatility rating of high; those that have vapor pressure of 10^{-5} to 10^{-4} are rated as moderate; and those that have vapor pressure of less than 10^{-5} are rated as low.

In addition to the influences of physiochemical properties and environment on the potential for pesticide movement, the persistence (ie. longevity) of pesticide residues is important. For example, a chemical that dissipates very quickly is not likely to pose much risk for runoff after the first heavy rain following application. A chemical that degrades slowly poses a risk of runoff or leaching long after application with each subsequent rainfall. The persistence of pesticides is described by a number called the half-life, which represents the time after application when 50% of the chemical has been deactivated by degradation processes. Although the half-life is useful for comparing the longevity of pesticides, its numerical value is greatly influenced by environmental conditions, especially soil type. Also, as the concentration of the pesticide continues to decrease during the growing season, the rate of decrease will slow significantly.

PESTICIDE SELECTION WITH REGARD TO RELATIVE RISK TO WATER RESOURCES:

The properties of the pesticides given in the pesticide data base list are intended to help the producer make decisions regarding relative risk of contaminating groundwater and surface water resources. The estimate of risk to water resources in this Appendix, or derived from these tables should not be considered precise recommendations of pesticide use because too many variables are involved. The estimates of risk should be considered a first approximation and a guide for better management. Specific recommendations for pesticide use should be based on the latest information from the Illinois Cooperative Extension Service. To obtain the best use of these data, all properties listed for any one pesticide must be considered together with the environmental conditions (especially soil properties). Also the operational characteristics of the pesticide application must be considered. These operational characteristics include: time of year, formulation, rate of application, and possible exposure of nontarget organisms. The decision to use a registered product should be made on the basis of its effectiveness on the target crop pest, and also with consideration of the lowest risk to water resources and nontarget organisms.

DEFINITION OF TERMS:

Common name

The common names are generic names. They refer to a chemical compound without naming a specific product. There are a few pesticides which do not have a common name. These are listed by trade name.

In some cases, one common name may be used for several chemically-related compounds. "2,4-D," for example, is available in the acetic acid form, the ester form, and soluble salt form. These three forms of 2,4-D have considerably different properties, so as pesticides, they are listed separately. Still, many people refer to all forms by the common name, "2,4-D."

U.S. trade name and manufacturers

Some pesticide compounds are formulated as tradename products for sale by only one manufacturer. Compounds that have outlived patent protection, however, may have several trade names.

A specific product registered with the US EPA must have a defined active ingredient, "ai," at a defined concentration. Some companies, however, confuse things by using nearly the same trade name for two or more products that contain entirely different active ingredients.

Many trade names involve more than one active ingredient. Some common names involve many trade names, several different formulations, and possibly chemical derivatives. Whether a trade name or common is used, planners must know what the active ingredients are, and at what concentration.

Use

The use listing is included for general information. It is not complete because of frequent changes in the registered uses and should not be followed as a recommendation. Most of this information was taken from labels.

Formulation type

Formulation is the physical form in which a product is packaged and is specific for a given product. For example, "D.Z.N. Diazinon 4E" is a product of Ciba-Geigy which contains four pounds of diazinon per gallon and is a 46.5% diazinon solution. The diazinon is dissolved in a hydrocarbon solvent with surfactants, which allow the solution to be easily mixed with water to form an emulsion suitable for spraying.

Formulation type is important in predicting pesticide behavior. The long-term (weeks to months) life of a pesticide will be a function of its physical properties and persistence, but its initial life (hours to days) will be a function of its formulation. For example, about 30 times more wettable powders than emulsified concentrates will be lost if both are applied to soil surfaces and immediately subjected to rain.

Most formulation types are designed to be mixed with water and sprayed through nozzles. These formulations can be described as:

1. Wettable powders which are added to spray water and kept in suspension by agitation.

2. Aqueous concentrates which are water-based mixtures diluted with spray water.

3. Emulsifiable concentrates which form emulsions in the spray tank and are kept mixed by agitation.

4. Dispersible liquids which are suspensions of very fine pesticide particles in a thick liquid and thinned with spray water.

5. Dispersible granules which are powders formed into granules and break down on contact with water and form a suspension similar to wettable powders.

6. Soluble solutions are solutions of the "ai" in a solvent that is mixable with water.

7. Microcapsules which are tiny polymer spheres containing the "ai" and suspended in the water.

8. Soluble powders which dissolve in water.

Formulations which are not designed to be mixed in water include granules and pellets which are applied by spreaders, and oil-based materials designed to be sprayed in various oil.

Application mode

The application mode is important in determining the primary location of the pesticide in the target area. The pesticide location determines the initial behavior. The importance of location is illustrated by comparing Trifuralin, a herbicide, and Carbaryl, an insecticide.

Trifuralin is typically applied as a spray to a bare soil surface and mixed in. It is volatile and will evaporate if left on the surface. Weeds are killed as they sprout in the soil.

Carbaryl, a wettable powder, is applied to vegetation such as apple trees for insect control and is easily washed off leaves by water.

Trifuralin is fairly persistent but is a low runoff risk because it is incorporated into soil. Carbaryl has a high runoff potential because it is a wettable powder applied to leaves. Carbaryl persistence, however, is short, as the active ingredients dissipate rapidly when exposed to sun and wind.

The application mode depends on the spray target, such as weed or crop plants, and whether it is applied to the soil surface or incorporated into the soil. Both runoff and persistence will be strongly affected by where the active ingredient ends its flight from the nozzle. In many cases, the final location of the pesticide will be divided between soil, foliage, and air. Only the major deposition location is listed in the data base.

Solubility in water

The solubility of the pesticides in water at room temperature is given in ppm (mg/l). This is the solubility of the pure ai, not the formulated product. Solubility is a fundamental physical property of a chemical and will strongly affect the ease of washoff and leaching through soil. In general, pesticides with solubilities of 1 ppm or less will tend to stay at the soil surface and be washed off the field in the sediment phase of runoff. Thus practices designed to reduce erosion will also stop pesticide runoff. An "E" code means the solubility value given is an estimate and may be in error by up to a factor of three. A "G" code means literally that a guess estimate of the solubility has been made and the error may be one or two orders of magnitude.

Half-life in soil

Half-life, given in days, is the time required for pesticides in soils to be degraded so that their concentration decreases by one-half. Pesticide degradation can be fairly accurately described by assuming that each successive elapsed half-life will decrease the pesticide concentration by half, so, for example, a period of two half-lives will reduce a soil concentration to one-fourth of the initial amount. "Persistence times" often reported in the literature are the times required for a pesticide to degrade to the point that it is no longer active. We have arbitrarily assumed this equal to four half-lives when a persistence time was the only data available.

Half-lives vary by a factor of three or more depending on soil moisture, temperature, oxygen status, soil microbial population and other factors. The numbers given should only be used as relative indicators of persistence. "E" codes mean the value is estimated and is probably in error by a factor of two or more. "G" codes mean the estimate could be off by a factor of three or more.

These half-lives are for pesticides in the interior of the soil and generally refer to chemical or microbiological degradation. Pesticides deposited on the soil surface or deposited on leaf or crop litter surfaces, and remaining there because of an absence of rain, are also subject to evaporation and sunlight and generally show half-lives of only a few days or less.

Soil sorption index

The index for soil sorption is measured by the Koc value. The Koc measures the tendency of the pesticide to be strongly attached, by chemical or physical bonds, to soil particle surfaces. The higher Koc values (1000) have a stronger attachment to soil and a lesser tendency for the pesticide to move except with sediment movement. Conversely, the lower Koc values will tend to move with water and have a potential for deep percolation below the root zone or being carried in runoff water. The "E" code means a probable error of 3x - 5x and a "G" code means a probable error of 10x - 100x.

Runoff potential

The runoff potential indicates the tendency of the pesticide to move with sediment in runoff. A rating of large means the pesticide has a high tendency to move with sediment, a rating of small means the pesticide has a low tendency to move with sediment, and a rating of medium has an intermediate tendency to move with sediment.

Leaching potential

The leaching potential indicates the tendency of a pesticide to move in solution with water and leach below the root zone into deep percolation. The ratings of large, medium, small, and very small describe the potential for leaching. A rating of large means the pesticide has a high tendency to leach, a rating of small means the pesticide hash a low tendency to leach, and a rating of medium means the pesticide has an intermediate tendency to leach. A rating of very small means the pesticide is totally used, totally decomposed, or that there is such a small amount remaining that it is not expected to leach with the percolating water.

PESTICIDE DATA BASE LIST:

The pesticide properties data in the following list is a selection of data fields and records from the USDA-ARS, Interim Pesticide Properties Data Base, Version 1.0, by R. D. Wauchope. Surface loss and leaching potentials are by the Soil Conservation Service. Some properties of the insecticides have been adjusted for Illinois by Dr. Allan Felsot, Agricultural Entomologist, Illinois State Natural History Survey, Champaign, Illinois.

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The pesticides in the list represent the most commonly used active ingredients for agricultural production in Illinois in 1988.

E = Estimate value; probable error is 2X to 3X for Half life, and 3X to 5X for Solubility and 'Koc'
G = guess value; probable error is 5X for Half life, and 1 to 2 orders of magnitude for Solubilities and 'Koc'

Pesticide Data Base List:

```
Tradename:c     2,4-D
Commonname:c    2,4-D Sol. amine salt
Manufacturer:c  Rhone-Poulenc
Kind            h
Use:c           h: lawns, small grain, corn, sorghum, pasture
Formulation     aqueous solution
Application     target weed foliar spray
Solubility      300,000
HalfLife        10
Sorption        109
RunoffPot:c     medium
LeachingPot:c   medium
Vpressure
Volatility

Tradename:c     2,4-DB
Commonname:c    2,4-DB Ester
Manufacturer:c  Rhone-Poulenc
Kind            h
Use:c           h: alfalfa, birdsfoot trefoil
Formulation     emulsifiable concentrate
Application     target weed foliar spray
Solubility      50 E
HalfLife        10 E
Sorption        1000 E
RunoffPot:c     medium
LeachingPot:c   small
Vpressure
Volatility

Tradename:c     Amiben
Commonname:c    chloramben
Manufacturer:c  Rhone-Poulenc
Kind            h
Use:c           h: soybeans
Formulation     aqueous solution, granules, soluble powder
Application     soil surface spray, sometimes soil incorporated
Solubility      300,000 E
HalfLife        14
Sorption        15
RunoffPot:c     small
LeachingPot:c   large
Vpressure
Volatility
```

Pesticide Data Base List:

Tradename:c Assure
Commonname:c quizalofop
Manufacturer:c DuPont
Kind h
Use:c h
Formulation emulsifiable concentrate
Application target weed foliar spray
Solubility 0.3
HalfLife 140
Sorption 100,000E
RunoffPot:c large
LeachingPot:c small
Vpressure
Volatility

Tradename:c Atrizine
Commonname:c atrizine
Manufacturer:c Ciba-Geigy, DuPont
Kind h
Use:c h: corn, sorghum, noncropland
Formulation wettable powder, dispersible liquid, granules
Application soil spray, target plant foliar spray
Solubility 33
HalfLife 60
Sorption 160
RunoffPot:c medium
LeachingPot:c large
Vpressure
Volatility

Tradename:c Banvel
Commonname:c dicamba
Manufacturer:c Sandoz
Kind h
Use:c h: small grain, corn, sorghum, noncropland
Formulation aqueous concentrate
Application soil surface spray, target plant foliar spray, rope wick
Solubility 800,000
HalfLife 14
Sorption 2
RunoffPot:c small
LeachingPot:c large
Vpressure
Volatility

Pesticide Data Base List:

```
Tradename:c     Basagran
Commonname:c    bentazon
Manufacturer:c  BASF
Kind            h
Use:c           h: soybeans, corn
Formulation     concentrated aqueous solution
Application     target plant foliar spray
Solubility      2,300,000
HalfLife        10
Sorption        35
RunoffPot:c     small
LeachingPot:c   medium
Vpressure
Volatility

Tradename:c     Bladex
Commonname:c    cyanazine
Manufacturer:c  DuPont
Kind            h
Use:c           h: corn, sorghum, fallow cropland
Formulation     dispersible liquid, wettable powder, dispersible
granules
Application     soil surface spray, sometimes soil incorporated
Solubility      171
HalfLife        20
Sorption        168
RunoffPot:c     medium
LeachingPot:c   medium
Vpressure
Volatility

Tradename:c     Blazer
Commonname:c    acifluorfen
Manufacturer:c  Rhone-Poulenc, BASF
Kind            h
Use:c           h: soybeans, other legumes
Formulation     concentrated aqueous solution
Application     soil spray, target plant foliar spray
Solubility      900,000
HalfLife        30
Sorption        139
RunoffPot:c     medium
LeachingPot:c   medium
Vpressure
Volatility
```

Pesticide Data Base List:

```
Tradename:c     Buctril
Commonname:c    bromoxynil ester
Manufacturer:c  Rhone-Poulenc
Kind            h
Use:c           h: small grain, sorghum, corn, noncropland
Formulation     emulsifiable concentrate
Application     target foliar plant spray
Solubility      50 E
HalfLife        14
Sorption        1000 E
RunoffPot:c     medium
LeachingPot:c   small
Vpressure
Volatility

Tradename:c     Classic
Commonname:c    chlorimuron-ethyl
Manufacturer:c  DuPont
Kind            h
Use:c           h: soybeans
Formulation     dispersible granules
Application     target weed foliar spray, soil surface
Solubility      500 E
HalfLife        50
Sorption        20
RunoffPot:c     small
LeachingPot:c   large
Vpressure
Volatility

Tradename:c     Command
Commonname:c    clomazone
Manufacturer:c  FMC
Kind            h
Use:c           h: soybeans
Formulation     emulsifiable concentrate
Application     soil incorporated
Solubility      1100
HalfLife        30
Sorption        100 E
RunoffPot:c     medium
LeachingPot:c   large
Vpressure
Volatility
```

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Pesticide Data Base List:

```
Tradename:c     Dual
Commonname:c    metolachlor
Manufacturer:c  Ciba-Geigy
Kind            h
Use:c           h: corn, soybeans, sorghum, tree fruits
Formulation     emulsifiable concentrate, granules
Application     soil surface spray, soil incorporated
Solubility      530
HalfLife        20
Sorption        200
RunoffPot:c     medium
LeachingPot:c   medium
Vpressure
Volatility

Tradename:c     Eradicane
Commonname:c    EPTC plus safener
Manufacturer:c  ICI Americas
Kind            h
Use:c           h: corn, alfalfa
Formulation     emulsifiable concentrate, granules
Application     soil incorporation, chemigation, dry fertilizer mix
Solubility      375
HalfLife        30
Sorption        280
RunoffPot:c     medium
LeachingPot:c   medium
Vpressure
Volatility

Tradename:c     Fusilade
Commonname:c    fluazifop-P-butyl
Manufacturer:c  ICI Americas
Kind            h
Use:c           h: soybeans, noncropland
Formulation     emulsifiable concentrate
Application     target weed plant spray
Solubility      2
HalfLife        20
Sorption        3000 E
RunoffPot:c     large
LeachingPot:c   small
Vpressure
Volatility
```

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Pesticide Data Base List:

```
Tradename:c     Gramoxone
Commonname:c    paraquat dichloride sol. salt
Manufacturer:c  ICI Americas
Kind            h
Use:c           h: alfalfa, turf, fruits
Formulation     aqueous concentrated solution
Application     target weed plant spray
Solubility      1,000,000
HalfLife        3600 E
Sorption        100,000
RunoffPot:c     large
LeachingPot:c   small
Vpressure
Volatility

Tradename:c     Lasso
Commonname:c    alachlor
Manufacturer:c  Monsanto
Kind            h
Use:c           h: corn, soybeans, sunflowers, turf
Formulation     dispersible granules, microencapsulated
Application     soil spray, soil granular application, soil
incorporated
Solubility      242
HalfLife        14
Sorption        190
RunoffPot:c     medium
LeachingPot:c   medium
Vpressure
Volatility

Tradename:c     Lexone
Commonname:c    metribuzin
Manufacturer:c  Pennwalt
Kind            h
Use:c           h: alfalfa, corn, soybeans, wheat, barley,
noncropland
Formulation     microcapsules, imulsifiable concentrate, wettable
powder
Application     crop foliar spray, chemigation
Solubility      60
HalfLife        5
Sorption        5100
RunoffPot:c     medium
LeachingPot:c   large
Vpressure
Volatility
```

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Pesticide Data Base List:

```
Tradename:c     Lorox
Commonname:c    linuron
Manufacturer:c  DuPont
Kind            h
Use:c           h: corn, soybeans, sorghum
Formulation     wettable powder, dispersible granules, dispersible
liquid
Application     soil surface spray
Solubility      75
HalfLife        60
Sorption        863
RunoffPot:c     large
LeachingPot:c   medium
Vpressure
Volatility

Tradename:c     Poast
Commonname:c    sethoxydim
Manufacturer:c  BASF
Kind            h
Use:c           h: soybeans, alfalfa, sunflower, fruits, vegetables
Formulation     emulsifiable concentrate
Application     target weed foliar spray
Solubility      1000
HalfLife        5
Sorption        50 E
RunoffPot:c     small
LeachingPot:c   small
Vpressure
Volatility

Tradename:c     Princep
Commonname:c    simazine
Manufacturer:c  Ciga-Geigy
Kind            h
Use:c           h: aquatic weeds, noncropland, turf, corn, fruit
crops
Formulation     wettable powder, granules, dispersible liquid
Application     soil surface spray, pond surface
Solubility      3.5
HalfLife        75
Sorption        138
RunoffPot:c     medium
LeachingPot:c   large
Vpressure
Volatility
```

Pesticide Data Base List:

```
Tradename:c     Prowl
Commonname:c    pendimethalin
Manufacturer:c  American Cyanamid
Kind            h
Use:c           h: corn, sorghum, soybeans, vegetables
Formulation     emulsifiable concentrate
Application     soil surface spray
Solubility      0.5
HalfLife        60
Sorption        24,300
RunoffPot:c     large
LeachingPot:c   small
Vpressure
Volatility

Tradename:c     Ramrod
Commonname:c    propachlor
Manufacturer:c  Monsanto
Kind            h
Use:c           h: corn, sorghum, pumpkin, peas
Formulation     dispersible liquid, granules
Application     soil surface spray
Solubility      580
HalfLife        7
Sorption        420
RunoffPot:c     medium
LeachingPot:c   small
Vpressure
Volatility

Tradename:c     Reflex
Commonname:c    fomesafen sodium salt
Manufacturer:c  ICI Americas
Kind            h
Use:c           h: soybeans
Formulation     aqueous concentrate
Application     target weed foliar spray
Solubility      600,000
HalfLife        180
Sorption        50 E
RunoffPot:c     medium
LeachingPot:c   large
Vpressure
Volatility
```

Pesticide Data Base List:

```
Tradename:c     Roundup
Commonname:c    glyphosate amine sol. salt
Manufacturer:c Monsanto
Kind            h
Use:c           h: corn, soybeans, wheat, noncropland, aquatic weeds
Formulation     aqueous concentrated solution
Application     target plant foliar spray, wiper applicator
Solubility      1,000,000
HalfLife        30
Sorption        10,000 E
RunoffPot:c     large
LeachingPot:c   small
Vpressure
Volatility

Tradename:c     Scepter
Commonname:c    imazaquin sol. ammonium salt
Manufacturer:c American Cyanamid
Kind            h
Use:c           h: soybeans
Formulation     aqueous concentrate
Application     target foliar spray, soil surface, soil incorporated
Solubility      160,000
HalfLife        60
Sorption        20 E
RunoffPot:c     small
LeachingPot:c   large
Vpressure
Volatility

Tradename:c     Sencor
Commonname:c    metribuzin
Manufacturer:c DuPont, Mobay
Kind            h
Use:c           h: alfalfa, corn, soybeans, wheat, vegetables,
noncropland
Formulation     dispersible liquid, dispersible granules
Application     soil surface, chemigation
Solubility      1220
HalfLife        30
Sorption        41
RunoffPot:c     medium
LeachingPot:c   large
Vpressure
Volatility
```

Pesticide Data Base List:

Tradename:c	Sonalan
Commonname:c	ethalfluralin
Manufacturer:c	Elanco
Kind	h
Use:c	h: soybeans, sunflower
Formulation	emulsifiable concentrate
Application	soil incorporated
Solubility	0.2 E
HalfLife	60 E
Sorption	471,000
RunoffPot:c	large
LeachingPot:c	small
Vpressure	
Volatility	

Tradename:c	Sutan+
Commonname:c	butylate plus safener
Manufacturer:c	ICI Americas
Kind	h
Use:c	h: corn
Formulation	emulsifiable concentrate, granules
Application	soil incorporated
Solubility	45
HalfLife	12
Sorption	540
RunoffPot:c	medium
LeachingPot:c	small
Vpressure	
Volatility	

Tradename:c	Tandem
Commonname:c	tridiphane
Manufacturer:c	Dow
Kind	h
Use:c	h: corn
Formulation	emulsifiable concentrate
Application	target weed foliar spray
Solubility	1.8
HalfLife	28
Sorption	5600
RunoffPot:c	large
LeachingPot:c	small
Vpressure	
Volatility	

Pesticide Data Base List:

Tradename:c	Treflan
Commonname:c	trifluralin
Manufacturer:c	Elanco
Kind	h
Use:c	h: soybeans, wheat, sunflower
Formulation	emulsifiable concentrate, granules
Application	soil incorporated
Solubility	0.3
HalfLife	60
Sorption	1400
RunoffPot:c	large
LeachingPot:c	small
Vpressure	
Volatility	

Tradename:c	Aastar
Commonname:c	flucythrinate
Manufacturer:c	DuPont, American Cyanamid
Kind	i
Use:c	i: corn, tree fruits
Formulation	emulsifiable concentrate, granules
Application	crop plant spray in water or vegetable oil, granules on soil
Solubility	0.5
HalfLife	50
Sorption	100,000
RunoffPot:c	small
LeachingPot:c	medium
Vpressure	(no data)
Volatility	-

Tradename:c	Ambush
Commonname:c	permethrin
Manufacturer:c	ICI Americas, FMC
Kind	i
Use:c	i: corn, soybeans, fruits, vegetables
Formulation	emulsifiable concentrate, wettable powder, granules
Application	crop plant spray, chemigation
Solubility	0.04
HalfLife	30
Sorption	10,600
RunoffPot:c	medium
LeachingPot:c	small
Vpressure	4.5x10**-7
Volatility	low

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Pesticide Data Base List:

```
Tradename:c     Broot
Commonname:c    trimethacarb
Manufacturer:c  Rhone-Poulenc
Kind            i
Use:c           i: corn
Formulation     granules
Application     soil surface or incorporated
Solubility      58
HalfLife        42-63
Sorption        470
RunoffPot:c     medium
LeachingPot:c   medium
Vpressure       5.0x10**-5
Volatility      moderate

Tradename:c     Counter
Commonname:c    terbufos
Manufacturer:c  American Cyanamid
Kind            i
Use:c           i: corn, sorghum
Formulation     granules
Application     soil incorporated
Solubility      5
HalfLife        21-35
Sorption        578
RunoffPot:c     medium
LeachingPot:c   small
Vpressure       2.6x10**-4
Volatility      moderate

Tradename:c     Cygon
Commonname:c    dimethoate
Manufacturer:c  American Cyanamid
Kind            i
Use:c           i: corn, soybeans, wheat, noncropland, alfalfa
Formulation     emulsifiable concentrate
Application     soil surface
Solubility      25,000
HalfLife        <7
Sorption        17
RunoffPot:c     small
LeachingPot:c   medium
Vpressure       1.0x10**-5
Volatility      moderate
```

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Pesticide Data Base List:

```
Tradename:c     Dyfonate
Commonname:c    fonofos
Manufacturer:c  ICI Americas
Kind            i
Use:c           i: corn, sorghum, potatoes, vegetables
Formulation     emulsifiable concentrate, granules
Application     crop plant spray
Solubility      13
HalfLife        30-150
Sorption        680
RunoffPot:c     medium
LeachingPot:c   small
Vpressure       2.7x10**-4
Volatility      moderate

Tradename:c     Furadan
Commonname:c    carbofuran
Manufacturer:c  FMC, Mobay
Kind            i
Use:c           i: corn, sorghum, soybeans, alfalfa, small grain
Formulation     granules, dispersible liquid
Application     soil incorporated granules, crop foliar spray
Solubility      45
HalfLife        30-90
Sorption        45
RunoffPot:c     medium
LeachingPot:c   large
Vpressure       8.3x10**-6
Volatility      low

Tradename:c     Lorsban
Commonname:c    chlorpyrifos
Manufacturer:c  Dow
Kind            i
Use:c           i: corn, sorghum, soybeans, alfalfa, fruit trees
Formulation     emulsifiable concentrate, granules, wettable powder
Application     soil incorporation, crop foliar spray, chemigation
Solubility      1
HalfLife        30-90
Sorption        4600
RunoffPot:c     medium
LeachingPot:c   small
Vpressure       1.9x10**-5
Volatility      moderate
```

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Pesticide Data Base List:

```
Tradename:c     Malathilon
Commonname:c    malathion
Manufacturer:c  American Cyanamid
Kind            i
Use:c           i: many field crops, fruits, vegetables
Formulation     EC, oil solution
Application     contact spray
Solubility      145
HalfLife        <3
Sorption        280
RunoffPot:c     small
LeachingPot:c   small
Vpressure       4.0x10**-5
Volatility      moderate

Tradename:c     Mocap
Commonname:c    ethoprop
Manufacturer:c  Rhone-Poulenc
Kind            i
Use:c           i: corn, soybeans, potatoes, vegetables
Formulation     emulsifiable concentrate, granules
Application     soil incorporated or watered-in
Solubility      700
HalfLife        30-90
Sorption        120
RunoffPot:c     medium
LeachingPot:c   large
Vpressure       4.7x10**-4
Volatility      moderate

Tradename:c     Orthene
Commonname:c    acephate
Manufacturer:c  Chevron
Kind            i
Use:c           i:  soybeans, vegetables, pasture
Formulation     water soluble powder, dust
Application     crop foliar spray, spot spray
Solubility      790,000
HalfLife        <7
Sorption        3
RunoffPot:c     small
LeachingPot:c   medium
Vpressure       2.3x10**-5
Volatility      moderate
```

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Pesticide Data Base List:

```
Tradename:c     Penncap M
Commonname:c    methyl parathion
Manufacturer:c  Pennwalt
Kind            i
Use:c           i: alfalfa, corn, soybeans, small grain, fruits
Formulation     microcaplules, EC, wettable powder
Application     crop foliar spray, chemigation
Solubility      57
HalfLife        5
Sorption        9800
RunoffPot:c     small
LeachingPot:c   very small
Vpressure       1.3x10**-4
Volatility      moderate

Tradename:c     Pounce
Commonname:c    permethrin
Manufacturer:c  ICI Americas, FMC
Kind            i
Use:c           i: corn, soybeans, fruits, vegetables
Formulation     emulsifiable concentrate, wettable powder, granules
Application     crop plant spray, chemigation
Solubility      0.04
HalfLife        30
Sorption        10,600
RunoffPot:c     medium
LeachingPot:c   small
Vpressure       4.5x10**-7
Volatility      low

Tradename:c     Pydrin
Commonname:c    fenvalerate
Manufacturer:c  DuPont
Kind            i
Use:c           i: corn, soybeans, sunflower, noncropland, fruits
Formulation     emulsifiable concentrate
Application     crop plant spray in water or vegetable oils
Solubility      0.085
HalfLife        30-90
Sorption        100,000
RunoffPot:c     medium
LeachingPot:c   small
Vpressure       3.7x10**-7
Volatility      low
```

Pesticide Data Base List:

Tradename:c	Sevin
Commonname:c	carbaryl
Manufacturer:c	Chevron, Rhone-Poulenc
Kind	i
Use:c	i: many field crops, horticultural crops, turf
Formulation	wettable powder, dispersible granules, oil suspensions
Application	crop foliar sprays, chemigationd
Solubility	40
HalfLife	<30
Sorption	230
RunoffPot:c	medium
LeachingPot:c	small
Vpressure	<7.0x10**-3
Volatility	high

Tradename:c	Spectracide
Commonname:c	diazinon
Manufacturer:c	Ciba-Geigy, Pennwalt
Kind	i
Use:c	i: many field crops, forages
Formulation	WP, EC, oil solution, granules, microencapsulated
Application	structural sprays, soil drench, drop foliar spray
Solubility	40
HalfLife	14-56
Sorption	85
RunoffPot:c	large
LeachingPot:c	small
Vpressure	1.8x10**-4
Volatility	moderate

Tradename:c	Temik
Commonname:c	aldicarb
Manufacturer:c	Rhone-Poulenc
Kind	i
Use:c	i: soybeans, sorghum, potatoes
Formulation	granules
Application	granular application to soil, often with incorporation
Solubility	6,000
HalfLife	70
Sorption	28
RunoffPot:c	medium
LeachingPot:c	large
Vpressure	1.3x10**-4
Volatility	moderate

Pesticide Data Base List:

Tradename:c	Thimet
Commonname:c	phorate
Manufacturer:c	American Cyanamid
Kind	i
Use:c	i: alfalfa, corn, soybeans, small grain, sorghum
Formulation	granules
Application	soil application; systemic
Solubility	20
HalfLife	28-42
Sorption	431
RunoffPot:c	medium
LeachingPot:c	small
Vpressure	1.0x10**-2
Volatility	high

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COMMON NAME - TRADE NAME CROSS REFERENCE

Common Name	Trade Name
2,4-D Sol. amine salt	2,4-D
2,4-DB Ester	2,4-DB
EPTC plus safener	Eradicane
acephate	Orthene
acifluorfen	Blazer
alachlor	Lasso
aldicarb	Temik
atrizine	Atrizine
bentazon	Basagran
bromoxynil ester	Buctril
butylate plus safener	Sutan+
carbaryl	Sevin
carbofuran	Furadan
chloramben	Amiben
chlorimuron-ethyl	Classic
chlorpyrifos	Lorsban
clomazone	Command
cyanazine	Bladex
diazinon	Spectracide
dicamba	Banvel
dimethoate	Cygon
ethalfluralin	Sonalan
ethoprop	Mocap
fenvalerate	Pydrin
fluazifop-P-butyl	Fusilade
flucythrinate	Aastar
fomesafen sodium salt	Reflex
fonofos	Dyfonate
glyphosate amine sol. salt	Roundup
imazaquin sol. ammonium salt	Scepter
linuron	Lorox
malathion	Malathilon
methyl parathion	Penncap M
metolachlor	Dual
metribuzin	Lexone
metribuzin	Sencor
paraquat dichloride sol. salt	Gramoxone
pendimethalin	Prowl
permethrin	Ambush
permethrin	Pounce
phorate	Thimet
propachlor	Ramrod
quizalofop	Assure
sethoxydim	Poast
simazine	Princep
terbufos	Counter
tridiphane	Tandem
trifluralin	Treflan
trimethacarb	Broot

APPENDIX C

RATINGS FOR PESTICIDE LEACHING AND SURFACE LOSS POTENTIALS

INTRODUCTION:

This document describes a method used to evaluate the relative potential loss of pesticides from soils. Evaluation results are expressed as a relative potential for a specific pesticide to be lost when used on a specific soil. The GLEAMS (1) model was used to estimate pesticide losses from a large combination of hypothetical pesticides and soils. The estimated pesticide losses were ranked according to the amount of pesticide lost. Algorithms (computational procedures) using soil properties were developed to categorize soil series for leaching and surface water loss potential. Also, algorithms using pesticide properties were developed to categorize pesticides for leaching and surface water loss potential. The soil and pesticide categories are combined in a matrix to give a pesticide loss to surface runoff potential and a pesticide loss to leaching potential. (Appendix A)

(1) GLEAMS: Ground Water Loading Effects of Agricultural Management Systems by R. A. Leonard, W. G. Knisel, and D. A. Still. Transaction of the ASAE Vol 30 No 5, pp1403-1418, 1987.

BOUNDARIES OF CONSIDERATION:

A pesticide loss is assumed to have occurred if the pesticide is leached below the root zone, or leaves the field boundary in solution or adsorbed on sediment suspended in runoff waters. Thus, the boundaries are the bottom of the root zone and the edge of the field.

FACTORS AFFECTING RISK POTENTIAL:

The potential of losing pesticides from a field by surface water runoff or leaching below the root zone is a combined function of pesticide, soil, and climate factors. The pesticide loss assessments listed in this section have been developed by using a combination of soil and pesticide properties. The climatic factor has not been varied. The meteorological components used in the rating process are for evaluating potentials independent of climate and are not intended to represent any climatic zone. The primary goal was to determine the capacity of a soil to retain a pesticide at the point of application, regardless of management or climatic inputs.

FACTORS NOT INCLUDED IN PESTICIDE LOSS POTENTIAL:

Climate was not a variable in the pesticide loss potential determination. Storm size and frequency immediately after pesticide application will impact the amount of pesticide lost to surface runoff. This loss occurs as pesticide in solution and adsorbed on the sediment suspended in runoff waters. Another climate related impact occurs when pesticides that have a high leaching

potential are applied on soils with high infiltration rates. The pesticide will infiltrate below the root zone when a large or extended precipitation event occurs immediately after application. Therefore, the fact that a pesticide has been applied produces a potential for pesticide loss. This potential for loss occurs regardless of management practices that utilize pesticides.

Actual climatic data was not used in the GLEAMS model because of the several hundred potential climates that would require evaluation. Over 24,000 iterations of the GLEAMS model were required to test the hypothetical soils and pesticides without varying the climate. The meteorological data used in the model to estimate pesticide losses was artificially generated to represent the most likely situations for pesticide loss mentioned above.

An indirect climatic influence not considered in this assessment is soil temperature and moisture during the period the pesticide resides in the soil. The persistence or half-life of a pesticide in a soil is partially dependent on soil moisture and temperature. The degradation of the pesticide is favored by warm and moist climates. The difference in half-life rates of the pesticide due to soil moisture and temperature has not been considered. The half-life for a given pesticide was assumed constant, regardless of climate or geographic location.

The type of crop was not considered, and the method of pesticide application was not considered. The soil was assumed fallow and the application was to the soil surface. To consider each crop and method of application available for a pesticide is beyond the scope of this guide.

Some soil parameters that are thought to influence pesticide half-life rates or solubility have not been considered. These factors include soil pH, aluminum content, elements toxic to microbes, and total soil surface area.

FACTORS CONSIDERED IN PESTICIDE LOSS POTENTIAL:

Soils have been categorized according to the relative potential for pesticide loss from the surface (soil surface loss potential), or the relative potential for pesticide loss to leaching (soil leaching potential). The pesticides have been categorized according to the same potentials (pesticide surface loss potential or pesticide leaching potential).

Break points for each category were based on the percentage of applied pesticide lost to surface runoff or leaching. Multiple simulations of the GLEAMS model were used to estimate pesticide leaching below the root zone and pesticide losses in runoff. The categories for soil loss potentials are:

High
Intermediate
Nominal

The categories for pesticide loss potentials are:

Large
Medium
Small
Very Small

The pesticide was applied to the surface of a fallow soil sixteen, eight, four, and two days before, and on the day of the first major precipitation event. A 3.5 inch precipitation event was generated every second day for five events, and then a 1.0 inch event every other day for at least four times the half-life of the pesticide. The field was ten acres, square in shape, with a four percent slope. The rooting depth was set at 36 inches.

The pesticide variables tested were:

(1) half-life,
(2) solubility, and
(3) organic matter partitioning coefficient (KOc).

The soil variables tested were:

(1) surface horizon thickness,
(2) organic matter content of the surface horizon,
(3) surface texture,
(4) subsurface texture, and
(5) hydrologic soil group.

The estimated properties that vary with above inputs are:

(1) Effective saturated hydraulic conductivity, from texture and hydrologic group using (1: Table A-6, p. A-8.) (Fallow)

(2) Bulk density, from texture by NSSL method. The NSSL method utilizes the pedon data base for predicting the most probable bulk density from texture.

(3) SCS curve number, from hydrologic soil group using (1: Table A-4, p. A-5.) (Fallow, straight row)

(4) Porosity, from [1 - (bulk density/2.65]*100.

(5) Field capacity, from texture, using (1: Table A-3, p. A-4.)

(6) Wilting point, from texture, using (1: Table A-3, p. A-4.)

(7) Soil evaporation parameter, using (1: Table A-3, p. A-4.)

(8) Percent sand, silt, and clay, from texture, using (1: Table B-4, p. B-3.)

(1) CREAMS: A Field Scale Model for Chemicals, Runoff, and Erosion from Agricultural Management Systems. Conservation Research Report Number 26. USDA, Science and Education Administration. (These methods of evaluating properties also apply to GLEAMS)

The climatic constraints used for this method of ranking are somewhat rigid considering the wide variety of climates where pesticides are used. The precipitation inputs into the model are highly improbable in most climates. An additional constraint is methods of pesticide application relative to true application methods of the pesticide. However, these ranking of soils and pesticides are relative potential of how a soil and pesticide will interact. Pesticide losses from this model reflect only the relative ability of the soil to retain the pesticide at the point of application. The interplay of climate determines whether the leaching of surface loss potentials are reached in a given area.

DEVELOPMENT OF THE ALGORITHMS

Soil and pesticide categories were developed by using the results of multiple simulations using GLEAMS. An algorithm was developed to rank soils and pesticides for losses due to infiltration and for losses due to surface runoff. These algorithms were developed by ranking GLEAMS estimated pesticide losses for leaching or runoff into three groups. The pesticide loss would occur if a large precipitation event occurs immediately after application. The largest loss group has the potential for unacceptable losses regardless of management. The lowest loss group has little potential for loss regardless of management. The intermediate loss group has the potential for unacceptable losses, but may be reduced to acceptable losses by management. Selection of soil and pesticide properties for the algorithms was based on Factorial Analysis or Stepwise Regression. Both methods selected the properties that most influenced pesticide loss.

Leaching Algorithms:

Soils

The soils algorithm for ranking soils for potential loss to leaching are:

SOIL LEACHING POTENTIAL ALGORITHM

High:

If hydrologic group = A
 and organic matter times horizon #1 thickness <= 30 or
If hydrologic group = B
 and organic matter times horizon #1 thickness <= 5

Nominal:

If hydrologic group = A and
organic matter times horizon #1 thickness >= 65 or
If hydrologic group = B and
organic matter times horizon #1 thickness <= 45 or
If hydrologic group = C or
If hydrologic group = D.

Intermediate:

Everything else

Pesticides

The method of D.I. Gustafson (unpublished) was adopted and modified to rank pesticides (Groundwater Ubiquity Score: A Simple Method of Assessing Pesticide Leachability). There are certain classes of pesticides that will probably never be leached. These pesticides will have a very small leaching potential regardless of the soil type on which they are applied. This group of pesticides was ranked very small. The pesticide algorithm for ranking pesticides for potential loss to leaching are:

PESTICIDE LEACHING POTENTIAL ALGORITHM

Large:

If log(half-life)*(4 - log(KOc)) >= 2.8

Small:

If log(half-life)*(4 - log(KOc)) <= 1.8

Very Small:

If (solubility <1 or KOc >= 10,000) and
half life < 10.

Medium:

Everything else

Runoff Algorithms:

The loss of pesticides in surface runoff occurs in two phases, in the soluble and adsorbed phase. the current algorithm considers both phases combined. However, there is an advantage in separating these phases. This advantage is evident in considering management alternatives. Practices to manage water, the soluble phase, could be different than practices to manage sediment, the

adsorbed phase. The algorithms for surface losses are not as definite as the algorithms for leaching. The number of factors corollary to surface losses are much greater than those to leaching losses. The algorithm for ranking soils for potential loss to runoff are:

SOIL SURFACE LOSS POTENTIAL ALGORITHM

Values for hydrologic group: A = 1; B = 2; C = 3; D = 4

High:

If $\log((\text{soil k factor})*(\text{hydrologic group})^{5.7}) >= 2.8$

Nominal:

If $\log((\text{soil k factor})*(\text{hydrologic group})^{5.7}) <= 1.0$

Intermediate:

Everything else

The algorithm for ranking pesticides for potential loss to runoff are:

PESTICIDE SURFACE LOSS POTENTIAL ALGORITHM

Large:

If log(half-life)*(1.23 - log(KOc)) <= -2.4

Small:

If log(half-life)*(1.23 - log(KOc)) >= -0.4

Medium:

Everything else

APPENDIX D.

WORKER PROTECTION STANDARDS FOR AGRICULTURAL PESTICIDES
NOTICE OF PROPOSED RULEMAKING

SUMMARY OF PROVISIONS APPLICABLE TO AGRICULTURAL ESTABLISHMENTS

The Environmental Protection Agency proposes to revise its regulations for the protection of agricultural workers from pesticide exposure (40 CFR Part 170). The proposal was sent for comment to Congress, the US Department of Agriculture, the Office of Management and Budget, and the FIFRA Scientific Advisory Panel, and will be published in the Federal Register for public comment. The comment period will close in September, 1988. Following is a summary of the provisions of this proposal as they would apply to the use of pesticides on agricultural establishments, including farms, forests, nurseries and greenhouses.

A. General

1. Applicability

--Pesticide use sites covered include all agricultural establishments: farms, forests (only those used for commercial wood products production), nurseries and greenhouses.

--Pesticides covered include all products used on these sites. Exceptions include: livestock uses, golf course uses, right-of-way uses, direct injection, residential uses, post-harvest treatments, and pesticide research uses.

--Persons covered include all persons who handle or are otherwise exposed to pesticides on these sites, with the exception of the owner or lessee of the establishment and the owner/lessee's immediate family.

2. Responsibility

--Ultimate responsibility for compliance with worker protection requirements rests with the owner of the property on which a pesticide is used, or with the lessee in the case of leased property.

--Other persons who may be responsible under some circumstances include operators, supervisors, fieldworkers, and other employees of the owner/lessee; and labor contractors, application contractors, employees of contractors, and other agents of the owner/lessee.

--No person may take actions to prevent or discourage any person from compliance. However, employers are not prohibited from discharging or disciplining employees who fail to comply.

--Owners/lessees may be held responsible for non-compliance by their own employees and by their contractors, but such non-compliance must be taken into account in any enforcement action against the owner/lessee. Owners/lessees would not be held responsible for non-compliance by contractors or contractor's employees which occurs off of the property.

3. Labeling

--These regulations will not be printed in their entirety on product labeling, but will be made a part of labeling by means of a reference statement on labels.

--Requirements that vary from product to product, including personal protective equipment, reentry intervals, and posting, will appear on product labeling.

B. Requirements for the protection of workers

--POSTED INFORMATION. General pesticide safety rules, a facsimile of the pesticide warning sign, and the location of the nearest emergency medical facility must be posted in a prominent location.

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–NOTIFICATION. Workers must be notified of all pesticide applications that are made, unless no worker will be working in the treated area or in a neighboring area. The method of notification varies according to the type of establishment.

–REQUEST INFORMATION. Persons working in or near a treated area may request information about the application, including location of the treated area, reentry interval, time or date of application, product name, EPA registration number, and active ingredients.

–APPLICATION RESTRICTIONS. No worker may be in a pesticide-treated area during application, unless the worker is a handler involved in the application. No pesticide may be applied so as to contact any worker directly or through drift.

–REENTRY INTERVALS. In addition to existing reentry intervals, the following reentry intervals will be established for pesticide products: 48 hours for organophosphates and n-methyl carbamates in Toxicity Category I, 24 hours for all other products in Toxicity Category I, 24 hours for organophosphates and n-methyl carbamates in Toxicity Category II. The reentry interval for all other products will be until sprays have dried, dusts have settled, and vapors have dispersed.

–REENTRY RESTRICTIONS. During the reentry interval no worker may enter the treated area, unless the worker will have no contact with any treated surface, or unless all requirements for early reentry workers are met. Workers may not enter a treated area before sprays have dried to perform hand labor tasks under any circumstances.

–EMERGENCY CARE. If a pesticide poisoning is suspected, a worker must be provided with transporation to an emergency medical facility, and any available information related to the pesticide applied or the circumstances of application must be provided to the worker or to treating medical personnel.

–DECONTAMINATION. Soap, disposable towels, and a quantity of water sufficient for washing of hands and face must be available to workers handling pesticides, or working in places where pesticides have been used during the growing season, for decontamination.

C. Requirements for the protection of handlers

–Handling is defined as mixing, loading, application, flagging, equipment cleaning and repair, and disposal of pesticides.

–TRAINING. All handlers must be trained according to specified minimum requirements. Private applicator certification may substitute for the training requirement.

–PERSONAL PROTECTIVE EQUIPMENT. Handlers must wear all personal protective equipment (PPE) specified on the product label. If closed mixing/loading or application systems are used, PPE requirements are reduced or eliminated.

–PPE DUTIES. PPE must be provided in clean and working condition, and must be inspected regularly; a clean area must be provided to put on and remove PPE and to store personal clothing; contaminated PPE may not be worn or taken home by handlers, and must be cleaned seperately from other laundry; handling may not take place when PPE is required by the label and conditions are such that heat stress is likely.

–LABELING AVAILABILITY. Upon request, handlers must be provided the labeling of the products being handled.

–DECONTAMINATION. In addition to soap, towels, and water, an extra protective suit must be available to handlers in case a change of clothing is required by a spill or other contamination. If the label requires goggles or a face shield to be worn (which means that the product is a serious eye irritant), an eye wash dispenser must be available.

–WORKING ALONE. If the product has the skull and crossbones on the label (most acutely toxic), visual or voice contact must be made with the handler at least every 2 hours during handling activities. Handlers of fumigants in greenhouses must be under constant observation.

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D. Requirements for the protection of early reentry workers

--Early reentry workers are defined as workers who enter treated areas prior to the expiration of the reentry interval.

--TRAINING. Early reentry workers must receive the same training required for handlers.

--PERSONAL PROTECTIVE EQUIPMENT. Early reentry workers must wear all personal protective equipment required by the product labeling for an applicator. The same duties related to personal protective equipment as required for handlers (change area, etc.) apply to early reentry workers.

--DECONTAMINATION. An extra protective suit must be available during early reentry activities, and if the product is a serious eye irritant an eye wash dispenser must be provided.

E. Special farm and forestry requirements

--NOTIFICATION. Notification of pesticide applications on farms and in forests is through oral warnings and, for some pesticides, posting of warning signs:

> --For all pesticides, an oral warning must be given to any worker who will be in or near a treated area on the day of application or on any subsequent day that a reentry interval is in effect. The oral warning must be in a language that the worker can understand, and must include the location or description of the treated area and the reentry interval.
>
> --For pesticides with reentry intervals of greater than 48 hours, warning signs must be posted which are visible from all usual points of entry to the treated area. The size and content of the warning sign are standardized, including the words "DANGER--KEEP OUT" and a symbol to convey this message.

--"Hack and squirt" and "frill and spray" applications, which are common in forestry, are not considered to fall under the direct injection exemption from worker protection requirements.

F. Special nursery requirements

--REENTRY RESTRICTIONS. Following a pesticide application in a nursery, the area governed by the reentry interval (the "reentry-restricted area") will be the treated plant, bench, or growing area--or a larger area--depending on the application method and whether the sprays or dusts have settled:

> --For soil-directed applications (from a maximum height of 12 inches from the soil, either using a dry formulation or using coarse spray droplets and pressure less than 40 p.s.i.) the reentry-restricted area is the treated plant or area. However, if the product labeling requires a handler to use a respirator, the reentry-restricted area is the same as for downward-directed applications (see below).
>
> --For downward-directed applications (directed downwards from a height of more than 12 inches from the soil, either using fine spray droplets or using coarse spray droplets and pressure greater than 40 p.s.i. and less than 150 p.s.i.) the reentry-restricted area extends 25 feet beyond the perimeter of the treated plant or area on the downwind side and 10 feet beyond the perimeter in all other directions, until sprays and dusts have settled. After sprays and dusts have settled until the end of the reentry interval, the reentry-restricted area is the treated area.
>
> --For other applications (upward-directed, aerial, or using pressure greater than 150 p.s.i.) the reentry-restricted area includes the treated area and any moistened or dusted areas outside the treated area, until sprays and dusts have settled. After sprays and dusts have settled until the end of the reentry interval, the reentry-restricted area is the treated area.

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--NOTIFICATION. Notification of pesticide applications in nurseries is through posting of warning signs. For all pesticide applications, warning signs must be visible from all points of access to the reentry-restricted area. The size and content of the warning sign are standardized, including the words "DANGER--KEEP OUT" and a symbol to convey this message.

G. Special greenhouse requirements

--REENTRY RESTRICTIONS. Following a pesticide application in a greenhouse, the area governed by the reentry interval (the "reentry-restricted area") will be the treated bench--or a larger area--or the entire greenhouse, depending on the application method and whether the sprays or dusts have settled:

--For fumigant applications (identified as such on product labeling) the reentry-restricted area is the entire enclosed area, which is generally the entire greenhouse. The reentry interval for fumigants may be specified on product labeling as a permissible exposure level which must be reached. If no PEL is specified, the reentry interval will be a period of time based on what type of ventilation is used in the greenhouse and how much time elapses between application and ventilation.

--For smoke, mist, fog, and aerosol applications, the reentry-restricted area is the entire enclosed area.

--For soil-directed applications (from a maximum height of 12 inches from the soil, either using a dry formulation or using coarse spray droplets and pressure less than 40 p.s.i.) the reentry-restricted area is the treated area. However, if the product labeling requires a handler to use a respirator, the reentry-restricted area is the same as for plant-directed applications (see below).

--For plant-directed applications (from a height of greater than 12 inches from the soil, either using fine spray droplets or using coarse spray droplets and pressure greater than 40 p.s.i.): if ventilation occurs before sprays and dusts have settled, the reentry-restricted area is the entire enclosed area; if no ventilation occurs before sprays and dusts have settled, the reentry-restricted area extends 25 feet beyond the perimeter of the treated area. After sprays and dusts have settled, the reentry-restricted area is always the treated area.

--NOTIFICATION. Notification of pesticide applications in greenhouses is through posting of warning signs. For all pesticide applications, warning signs must be visible from all points of access to the reentry-restricted area. The size and content of the warning sign are standardized, including the words "DANGER--KEEP OUT" and a symbol to convey this message.

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Minimum Personal Protective Equipment and Normal Work Attire for Pesticide Handlers and Workers Reentering Treated Areas Before Sprays Have Dried

Route of exposure	Formulated product toxicity category			
	I	II	III	IV
Dermal or skin irritation potential [1].	Protective suit [2]; Chemical-resistant gloves [3]; Chemical-resistant shoes, shoe covers, or boots.	Protective suit; Chemical-resistant gloves; Chemical-resistant shoes, shoe covers, or boots.	Normal work attire [4]; Chemical-resistant gloves.	Normal work attire.
Inhalation	Respiratory protection device [5]	Respiratory protection device	No minimum [6]	No minimum.
Eye irritation potential	Goggles or face shield	Goggles or face shield	No minimum	Do.

[1] If dermal toxicity and skin irritation potential are known to be in different Toxicity Categories, the more toxic of the two shall be used.

[2] A protective suit is a loose-fitting one-or two-piece garment, such as a fabric coverall, that is worn over normal work attire and covers at a minimum the entire body except for the head, hands and feet.

[3] "Chemical-resistant" material allows no measurable movement of pesticide through the material during use.

[4] Normal work attire consists at a minimum of long pants and long sleeved shirt, shoes and socks.

[5] Respiratory protection device approved by the National Institute of Occupational Health and Safety (NIOSH) and the Mine Safety and Health Administration (MSHA) for the intended pesticide use.

[6] Although no minimum PPE is required by this Section for this Toxicity Category and route of exposure, PPE may be required by the Agency under these circumstances on a product-specific basis.

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MINIMUM PERSONAL PROTECTIVE EQUIPMENT FOR WORKERS REENTERING TREATED AREAS AFTER SPRAYS HAVE DRIED AND BEFORE THE EXPIRATION OF THE REENTRY INTERVAL

Route of exposure	Active ingredient toxicity category			
	I	II	III	IV
Dermal or skin irritation potential [1]	Protective suit; [2] Chemical-resistant gloves; [3] Chemical-resistant shoes, shoe covers, or boots.	Protective suit; Chemical-resistant gloves; Chemical-resistant shoes, shoe covers, or boots.	No minimum [4]	No minimum.
Eye irritation potential	Goggles or face shield	Goggles or face shield	No minimum	Do.

[1] If dermal toxicity and skin irritation potential are known to be in different Toxicity Categories, the more toxic of the two shall be used.

[2] A protective suit is a loose-fitting one- or two-piece garment, such as a fabric coverall, that is worn over normal work attire and covers at a minimum the entire body except for the head, hands and feet.

[3] "Chemical-resistant" material allows no measurable movement of pesticide through the material during exposure.

[4] Although no minimum PPE is required by this section for this Toxicity Category and route of exposure, PPE may be required by the Agency under these circumstances on a product-specific basis.

3.3.3 Minnesota

NUTRIENT MANAGEMENT (ACRE)

Minnesota Standard

I. Definition:

MANAGING A SOIL FERTILITY PROGRAM FOR PLANT GROWTH AND PRODUCTION.

II. Purpose:

MANAGING A SOIL FERTILITY PROGRAM CONSISTENT WITH PROFITABLE CROP PRODUCTION GOALS THAT IS ENVIRONMENTALLY ACCEPTABLE. THIS INCLUDES MANAGING ALL SOURCES OF PLANT NUTRIENTS SUCH AS ORGANIC WASTE, CHEMICAL FERTILIZER, NATURALLY OCCURRING NUTRIENTS AND THOSE RESULTING FROM LEGUME RESIDUES.

III. Conditions Where Practice Applies:

ON ALL LANDS WHERE PLANT NUTRIENTS ARE APPLIED.

IV. Planning Considerations:

A. This practice reduces the potential for applied nutrients to pollute surface or groundwater by limiting the amount applied to the soil to that needed to produce a crop consistent with the landusers goals.

B. All sources and forms of plant nutrients being made available for plant growth and production should be considered in developing a nutrient management plan. Develop a nutrient budget for the proposed crop.

C. Establish application rates of nutrients consistent with University of Minnesota recommendations based on regular soil test results, setting realistic yield goals and considering all sources of nutrients that will be available.

D. Nitrogen and phosphorous are critical nutrients in planning for water quality. Timing, placement, method of application, rate of application and form of fertilizer applied are important considerations for managing these nutrients.

E. Soil pH can impact the availability of both soil and applied sources of phosphorus. Plan to adjust low pH soils to the level best suited for the crops being grown.

F. Soil compaction may reduce availability and uptake of plant nutrients. Avoid field operations that may result in soil compaction whenever possible. Maintain good soil structure by returning organic matter to the soil and reducing or controlling field traffic.

G. On sandy soils during years of unexpected low yields unused NO_3-nitrogen may accumulate from applied fertilizer. This accumulation has a potential to leach through the soil profile and enter groundwater supplies.

Winter cover crops should be used to try and tie up unused nitrogen for recycling to later crops. This practice can only be used when adequate soil moisture is available or can be supplied with irrigation and when length of the remaining growing season will permit sufficient cover crop growth.

H. Organic wastes can provide an important source of nutrients. State and local regulations and the National Agriculture Waste Management Field Manual will provide guidance concerning waste utilization.

I. Plan soil erosion control practices to minimize soil loss and runoff that can carry attached and dissolved nutrients to surface waters. This is very important where soils contain high levels of phosphorus and/or potassium.

J. Operation, safety and maintenance:

1. Maintain application equipment in good operating condition to prevent injury to humans and contamination of the environment. Use the proper equipment and necessary precaution to prevent irrigation well contamination when using fertigation.

2. Calibrate application equipment to ensure that fertilizer application for the field is within $\pm$10% of the rates planned.

3. When cleaning equipment after nutrient application, remove or save excess material in an appropriate manner. Waste water resulting from flushing application equipment should be kept away from wells, streams, ponds, lakes, other water bodies, sinkholes and high runoff areas.

4. Avoid unnecessary exposure to hazardous chemical fertilizers and organic wastes. Wear protective clothing, a respirator, gloves and footwear when appropriate.

5. Dispose of product containers in an approved manner according to local and/or state regulations.

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6. Follow all local, state and federal regulations regarding the transport of fertilizers. Know what to do in case of an accidental fertilizer spill.

V. Specifications:

A. Sources of plant nutrients may include residual amounts in the soil, legume residues, organic waste, chemical fertilizer and NO_3-nitrogen contained in irrigation water. Chemical fertilizers are those products with a guaranteed analysis displayed in accordance with Minnesota's Fertilizer Soil Amendment And Plant Amendment Law.

Non-farm organic waste shall be analyzed for content as prescribed by Minnesota Law for land application. Consult Minnesota Polution Control Agencys rules on Sludge Management, 6 MCAR section 4.6101 through 4.6136.

On-farm generated wastes shall be assessed for nutrient content based on the livestock species and class and the waste storage and handling methods. Waste from all manure systems shall be analyzed after initial start up of a new operation to establish a trend in nutrient content and after any changes in manure handling methods, livestock or feeding that would cause a change in nutrient composition.

Credit for legume residue contributions shall be consistent with the current University of Minnesota Guidelines. Fertilizer recommendations provided with soil test results include this credit.

B. Nutrient application rates on agricultural land shall be based on soil test results. Recommendations shall be consistent with those from the University of Minnesota or a land grant university in an adjoining state, based on a realistic yield goal and shall consider all sources of nutrients that will be available. A nutrient budget shall be prepared for the crop to be grown.

See University of Minnesota Bulletin AG-BU-0519, Guide To Computer Programmed Soil Test Recommendations For Field Crops In Minnesota.

1. Setting Realistic Yield Goals

Base nutrient applications on a realistic yield goal for the crop to be produced. Unrealistic yield goals can result in excess nutrient application resulting in unnecessary production costs and an increased hazard for water quality degradation.

Utilize information on a soils inherent potential productivity along with historic yield information as a starting point. Take the previous five years yield information for the crop. Drop the high and low years and average the three remaining years. Add from 10 to 20 percent to this three year average. The resulting yield goal will usually approach but not exceed the historic highest yield attained.

See University of Minnesota Bulletin AG-MI-2275, Choosing A Yield Goal.

2. Frequency Of Soil Tests

For immobile nutrients such as phosphorous and potassium, soil samples shall be taken and analyzed once during the crop sequence. The minimum frequency shall be once during a three year period or before applying nutrients when the frequency of nutrient application is greater than three years.

See University of Minnesota Soils Fact Sheet No. 4 (1978), Sampling Soil for Fertilizer and Lime Recommendations.

Utilize the nitrate nitrogen test annually in those locations where this test is recommended. Delay taking soil samples for a nitrate test until after October 1 in Zones A and B and after September 15 in Zone C.

See University of Minnesota Bulletin AG-FO-2274, Using The Soil Nitrate Test For Corn In Minnesota.

C. Nutrient application includes method and timing of application. Plant nutrients may be applied as broadcast, starter, surface band other than starter or injected band applications. Any one method may have advantages under a given set of circumstances.

Fall fertilizer applications shall be incorporated where land slope exceeds 2% unless runoff control measures such as heavy residue cover, contour tillage, contour strip cropping or terraces have been applied. Nutrients shall not be applied in late fall or winter when soils are frozen or are covered with ice, on crusted snow or on snow deeper than 6-8 inches.

Nutrients may be applied in the early spring when soils are in rapid freeze/thaw cycles on fields where runoff control measures mentioned above have been applied.

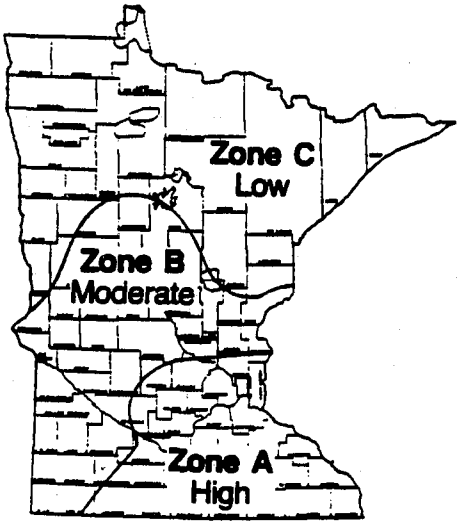

Figure 1: CLIMATIC ZONES AFFECTING NITROGEN LOSS POTENTIAL

Table 1: Nitrogen Loss Potential For Minnesota Soils [1/]

	Zone A Soil Texture [2/]			Zone B Soil Texture [2/]			Zone C Soil Texture [2/]		
	Coarse	Medium	Fine	Coarse	Medium	Fine	Coarse	Medium	Fine
Fall	VH	M	M	VH	L	L	M	L	L
Spr.Preplant	H	M	M	H	L	L	L	L	L
Sidedress or Split	M[3/]	L	L	M[3/]	L	L	L	L	

[1/] Potential Ratings:

VH-Very High, Probability for loss is greater than 8 years in 10.
H-High, Probability for loss is 6-8 years in 10.
M-Moderate, Probability for loss is 4-6 years in 10.
L-Low, Probability for loss is 3 or less years in 10.

[2/] Soil Texture:

Coarse - sand, loamy sand, sandy loam
Medium - silt, silt loam, loam
Fine - clay, clay loam, silty clay, silty clay loam, sandy clay loam, sandy clay

[3/] Sidedress or split applications made after June 15 have a low potential for loss.

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1. Nitrogen

Loss of NO_3-nitrogen from the soil is dependant upon soil textufe, application method and climate. Normally, with adequate soil moisture, nitrogen loss potential can be reduced by applying nitrogen fertilizer close to the time of greatest crop demand.

Figure 1 and Table 1 along with soils information for the field will identify the potential hazard for nitrogen loss.

General Guidelines

Use sidedress or split applications programs on irrigated, coarse-textured soils in Zones A and B.

Use sidedress applications on non-irrigated coarse-textured soils in Zones A and B.

Use spring and sidedress applications on medium and fine textured soils in Zone A.

Avoid using nitrogen sources which contain NO_3-nitrogen when conditions indicate a medium or high loss potential.

Nitrification inhibitors should be used with applications of urea, anhydrous ammonia or UAN (28%) where nitrogen loss potential in the table is rated high for fall or spring preplant applications and in fall applications when soil temperatures at four inches below the surface are 50 degrees F or greater and nitrogen loss potential is rated moderate or greater.

See University of Minnesota Report 186, Nitrogen Loss Potential and Nitrogen Fertilizer Management of Minnesota Soils.

2. Phosphorus, Potash and Micro Nutrients

Placing these nutrients in contact with the soil reduces the chance of runoff and loss. Lower rates of phosphorus and potash can be applied with an incorporated band application than with broadcast applications.

When soil test levels exceed 15 ppm phosphorus and 125 ppm potash no additional amounts of these nutrients will be applied unless a row applied starter fertilizer is recommended.

When soil test levels exceed 25 ppm phosphorus and 150 ppm potash no additional amounts of these nutrients will be applied except as row applied starter for corn on soil with limited drainage, when cool spring temperatures exist at planting time or in ridge-till and no-till conservation tillage systems. For root crops such as potatoes soil test levels for potash should exceed 200ppm before additional fertilizer is not recommended.

3. Organic wastes shall be tested for nutrient content and shall be injected or incorporated immediately after application unless nitrogen utilization is not an objective and surface runoff control measures such as heavy residue cover, contour tillage, contour strip cropping or terraces have been applied or surface runoff will not contribute to a water quality problem. A waste utilization plan shall be prepared.

Organic wastes spread adjacent to surface water, ditches, wetlands, tile inlets, waterways, sinkholes or water wells shall observe the separation distances listed in Table 2 and Table 3. Manure spread on land within a 10 year floodplain shall be incorporated.

Table 2: Recommended Separation Distance (feet) 1/

	Surface Spreading	Incorporation or Injection	Irrigation
Streams or Rivers	*	50	200
Lakes	*	100	300
Water Wells	200	200	200
Sinkholes	100	50	200

* See separation distances in Table 3.

1/ Source: Minnesota pollution Control Agency, Running your Feedlot- for farm economy and water resource protection.

Table 3: *Separation Distances From Surface Waters for Surface Application of Organic Wasters 1/

Slope %	Soil Texture	Time of Year	Separation Distances
0-6%	Coarse	May - October	100
0-6%	Coarse	November-April	200
0-6%	Medium to Fine	May - October	200
0-6%	Medium to Fine	November-April	300
>6%	Coarse	May - October	200
>6%	Medium to Fine	May - October	300
>6%	All soil	November-April	Not Recommended

1/ Source: Minnesota Pollution Control Agency, Running Your Feedlot - for farm economy and water resource protection.

D. Crop species perform best within a specific range of soil pH. Table 4 provides this information for common agricultural crops. Use a soil test to determine the need for liming materials.

E. Calibrate application equipment to ensure that fertilizer application for the field is within ± 10% of the rates planned.

F. Safety - Avoid unnecessary exposure to hazardous chemical fertilizer and organic wastes. Wear protective clothing including goggles, a respirator, gloves and footwear when handling potentially dangerous materials.

G. Clean equipment after nutrient application. Return excess material to the supplier or utilizer or store in an appropriate manner for furture use. Waste water resulting from flushing application equipment shall be kept away from wells, streams, ponds, lakes or other water bodies and out of sinkholes and high runoff areas. Follow all state and local regulations concerning storage of materials and disposal of product containers.

TABLE 4: Soil pH Range For Optimum Production For Common Crops

Annual Crops:

Barley	5.0-8.5	Rye	4.0-6.5
Bean, Field	5.5-6.5	Ryegrass,Annual	5.0-6.5
Bean, Green	4.0-7.5	Sorghums	5.0-7.5
Bean, Lima	5.5-7.5	Soybeans	5.5-7.5
Buckwheat	4.0-6.5	Sudangrass	5.0-7.5
Carrot	5.5-7.5	Sugarbeet	6.5-8.5
Corn	5.0-7.5	Tomato	6.5-7.5
Oats	5.0-8.5	Wheat	5.0-8.5
Onion	6.5-8.5		

Perennial Crops

Alfalfa	6.5-8.5	Kentucky Bluegrass	5.0-8.5
Asparagus	6.5-7.5	Orchardgrass	5.0-7.5
Birdsfoot Trefoil	5.5-6.5	Redtop	4.0-7.5
Clover, Alsike	4.0-7.5	Reed Canarygrass	5.0-7.5
Ladino	5.5-7.5	Ryegrass,Perennial	5.0-6.5
Red	6.5-7.5	Smooth Bromegrass	5.0-6.5
White	5.5-7.5	Strawberry	5.5-7.5
Crownvetch	5.5-8.5	Sweetclover	6.5-8.5
Fescue grasses	5.0-6.5	Timothy	5.0-7.5

VI. The following items shall be considered when planning this practice. Those items marked with an asterisks shall be recorded as minimum documentation requirements.

* 1. Location
* 2. Extent in acres
* 3. Nutrient budget worksheet
4. Source of nutrients
* 5. Nutrient timing and placement
6. Soil erosion control
7. Equipment operation and maintenance
8. Safety

VII. References:

University of Minnesota

AG-BU-0519, Guide To Computer Programmed Soil Test Recommendations For Field Crops In Minnesota,1985
AG-BU-3166, Understanding Nitrogen and Agricultural Chemicals In The Environment, 1987
AG-FO-0578, Fertilizer for Wheat in Minnesota, 1987
AG-FO-0579, Fertilizer for Alfalfa, 1987
AG-FO-0636, Fertilizer Urea, 1987
AG-FO-0725, Magnesium for Minnesota Soils, 1985
AG-FO-0723, Boron for Minnesota Soils, 1987
AG-FO-0792, Phosphorous for Minnesota Soils, 1987
AG-FO-2274, Using The Soil Nitrate Test For Corn In Minnesota, 1984
AG-FO-2392, Managing Nitrogen For Corn Production On Irrigated Sandy Soil, 1984
AG-FO-2613, Utilization of Animal Manure As Fertilizer, 1985
AG-FO-3425, Potato Fertilization on Irrigated Soils, 1988
AG-FO-3073, Using Anhydrous Ammonia in Minnesota, 1986
AG-FO-3553, Manure Management in Minnesota, 1988
AG-FS-0720, Zinc for Minnesota Soils, 1984
AG-MI-2275, Choosing a Yield Goal, 1984
EF 296 Fertilizer for Potatoes, 1974
EF 347 Copper For Organic Soils, 1983
EF 518 Potassium for Minnesota Soils, 1980
FS 4 Sampling Soil for Fertilizer and Lime Recommendations,1978
FS 16 Fertilizing Alfalfa on Sandy Loams and Coarser Soils, 1977
MR 186 Nitrogen Loss Potential and Nitrogen Fertilizer Management of Minnesota Soils1983
SS 108 Nitrate Carryover In The Soil Profile on Continuous Corn, 1980

Minnesota Pollution Control Agency:

Running Your Feedlot for farm economy and water resource protection

NUTRIENT BUDGET WORKSHEET

Field Number:_____ Date:_____
Soil Series:_____
Tillage Practices:_____
Previous Crop:_____Yield:_____
Planned Crop:_____Yield goal:_____
Soil Test Levels: P _____PPM; K _____PPM; pH_____
Nitrogen Nitrate Test: N_____PPM
Organic Waste-Nutrient Content:_____N/Ton ____P_2O_5/Ton_____K_2O/Ton
-Rate To Be Applied:_____Ton/Ac

	N	P_2O_5	K_2O
A. Soil Test Recommendation 1/			
B. Organic Waste Contribution 2/			
C. Nutrient Needs or Surplus			

1/ Recommendation from University of Minnesota credits results of a nitrate nitrogen test and legumes in crop sequence.

2/ Not all of the nutrients in manure are available to a crop in the year of application. All of the ammonium (NH_4) is available to the crop the first year after application minus losses due to storage and handling, volatilization from broadcast applications and denitrification from knife-injected applications.Organic N converted to plant-available forms during the first year after application ranges from 25-50%. Amounts released during the second, third and fourth years after application are 50%, 25%, and 12 1/2% respectively of the amount converted the first year. Generally 80% of phosphorous and potassium are available during the year of application.

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PEST MANAGEMENT (ACRE)
Minnesota Standard

I. Definition:

MANAGING PEST INFESTATIONS TO MINIMIZE ADVERSE EFFECTS ON PLANT GROWTH, CROP PRODUCTION AND ENVIRONMENTAL RESOURCES.

II. Purpose:

TO DEVELOP A PEST MANAGEMENT PROGRAM CONSISTENT WITH SELECTED CROP PRODUCTION GOALS THAT IS ENVIRONMENTALLY ACCEPTABLE. THIS INCLUDES APPROPRIATE CULTURAL, CHEMICAL, BIOLOGICAL AND/OR NATURAL CONTROLS.

III. Conditions Where Practice Applies:

ON ALL LAND USES WHERE PEST CONTROL IS DESIRED.

IV. Planning Considerations:

A. This practice limits the potential of pesticides in or on the soil and on plant foliage to pollute surface or ground water by careful pesticide selection and use, and eliminating unnecessary pesticide use to protect agricultural commodities. In addition this practice limits the adverse impacts of cultural and biological control methods on water quality.

B. Encourage the use of Integrated Pest Management systems that utilize the most appropriate means of pest control including cultural, biological and chemical methods. This will reduce the potential of pesticides to pollute surface or ground water.

C. Use field scouting and economic thresholds to determine when and if pesticides should be used. Treatment thresholds for certain pests and crops are available from the Cooperative Extension Service. Avoid unnecessary and poorly timed application of pesticides.

D. Consider pesticide characteristics such as water solubility, toxicity, degradation, adsorption, efficacy, and cost as well as site characteristics such as soil texture and organic matter, geology, depth to water table, proximity to surface water, topography and climate when selecting

pesticides such that the potential for pesticide pollution of surface and ground water is minimized.

E. Plan erosion control practices to minimize soil loss and runoff that can carry adsorbed or dissolved pesticides to surface waters.

F. If possible postemergence applications of pesticides should be forgone just prior to predicted rainfall to prevent surface water contamination and poor control of target organisms.

G. Consider band applications of pesticides where appropriate to reduce environmental hazards and treatment costs.

H. Avoid repetitive use of the same pesticide or pesticides of similar chemistry to reduce the potential for pesticide resistance development and shifts in the pest spectrum.

I. Use appropriate precautions when working with those pesticides that are highly toxic to non-target organisms.

J. Proper handling of pesticides and operation and maintenance of equipment are important to protect the applicator as well as the environment.

K. Those persons using pesticides need to:

1. Become fully trained and licensed to apply restricted use pesticides.

2. Read and follow all label directions. Additional information is available from Material Safety Data Sheets.

3. Calibrate application equipment before and periodically throughout each seasons use. Replace worn nozzle tips, cracked hoses, and faulty gauges.

4. Buy only the amount of pesticide needed for the job. Store pesticides in the original labeled containers, preferably in a locked building with appropriate warning signs away from feed and other products which could be contaminated.

5. Preasure rinse or triple rinse pesticide containers and add rinsate to spray solution.Clean application equipment after each use. Apply rinsate to a labeled site according to label directions.

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6. Dispose of excess material and product containers according to local, state and federal regulations. Never reuse pesticide containers for any purpose.

7. Avoid exposure to pesticides. Wear protective clothing, a respirator, gloves and footwear as indicated on the pesticide label. Bathe after possible dermal exposure and prior to eating, drinking or smoking. Know what to do in case of accidental pesticide exposure. Wash protective equipment and clothing in an appropriate manner to avoid further contamination.

8. Avoid spray drift by applying pesticides only when wind speeds do not exceed label directions or local, state or federal regulations.

9. Follow product label directions as well as local, state and federal regulations regarding posting and field reentry restrictions for treated areas.

10. Follow all local, state and federal regulations regarding the transport of pesticides. Know what to do in case of an accidental pesticide spill.

11. Assure that the pesticide applicator knows the exact location of the area to be treated and the potential hazard of spray drift or subsequent pesticide movement to surrounding areas.

12. Know what to to do in case of accidental pesticide poisoning. Have a pesticide first aid kit readily available. Check the product label for instruction and call the nearest poison center in the event a pesticide is swallowed.

    Minnesota Regional Poison Center
    Greater Minnesota and East Metro
    (612) 221-2113
    1-800-222-1222

    Hennipin County Regional Poison Center
    West Metro
    (612) 347-3141

    Product labels may also contain a telephone number where expert information is also available.

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V. Specifications:

A. **The principles of an Integrated Pest Management** (IPM) program will be applied when managing pest infestations. IPM includes:

1) Scouting and proper identification of the pest problem.

2) Evaluate alternatives and select an appropriate tactic.

3) Consider economics of alternatives, including whether it pays to use pesticides.

4) Evaluate the effectiveness of the alternative selected.

B. **Alternative pest management methods** include cultural, biological, and chemical controls. An effective pest management program may include some aspects of one or all methods. Each has benefits as well as limitations or drawbacks. A good IPM program helps the decision maker consider the costs, risks and benefits associated with a given course of action.

The most common pests affecting crop growth and production are disease, insect and weeds. Selected methods for control of these pests will include one or more of the methods listed below:

1. **Disease** - A plant disease is an abnormal condition that affects the structure or function of a plant. It is caused by a disease producing agent and is harmful in some way, even though the harm may not always be readily detected. The most common cause of parasitic diseases are fungi, bacteria, viruses and nematodes.

Cultural Disease Control Methods:

* Selection of planting sites and planting dates.

* Use resistant varieties or disease free seed when available.

* Use crop rotation and good sanitation practices.

* Reduce stress on plants by providing proper nutrients, water, pH and soil conditions that favor rapid establishment and vigorous growth.

* Remove infected plants or plant parts.

* Use fallow or non-susceptible crops for one growing season. Leaving the land fallow may increase soil erosion.

* Use tillage practices to bury diseased plant parts. However this may increase soil erosion and stimulate weed pests.

* Treat soil and plant parts with heat.

Biological Disease Control Methods:

* Use organisms that are antagonistic to the disease.

Chemical Disease Control Methods:

* Use chemicals to protect the host plant before it is infected.

* Use pesticides to eradicate the pathogen after it has infected the host plant.

* Use the correct chemical and rate for the pest.

* Reduce pathogen resistance development potential by using the lowest pesticide rate practical, apply uniformly, rotate pesticides and use spot treatment when possible. Select less persistent pesticides if available. Avoid repeated use of pesticides with a similar mode of action.

* Select chemicals that will be least harmful to the environment. Apply these products according to label instructions to minimize surface runoff and leaching. See Table 1 for pesticide characteristics to evaluate environmental impacts.

2. **Insects** - Insects are considered pests when they cause economic or esthetic losses or when they create inconvenience, annoyance or health problems.

Cultural Insect Control Methods:

* Use crop rotation.

* Use Resistant varieties.

* Adjust planting dates to minimize infestations.

* Time harvest to minimize losses from insects.

* Tillage practices may help reduce infestations of some insects. However tillage practices will be selected for reasons other than insect control.

* Control alternative host plants.

* Use sanitation to remove existing infestations or the resources necessary for a pest buildup.

Biological Insect Control Methods:

* Protect the natural enemies of insect pests.

* Utilize natural enemies or their products.

Chemical Insect Control Methods:

* Use insecticides to control insect impacts on plant growth and production.

* Use the correct insecticide and application rate for the insect.

* Reduce insect resistance potential by using the lowest insecticide rate practical, apply uniformly, rotate insecticides and use spot treatment when possible. Select less persistent insecticides if possible. Avoid repeated use of insecticides with a similar mode of action.

* Select insecticides that will be least harmful to beneficial insects and to the environment. Apply these products according to label instructions to minimize surface runoff and leaching. See Table 1 for insecticide characteristics to evaluate environmental impacts.

3. **Weeds** - A weed is any plant out of place that can reduce desirable plant growth and production, reduce crop quality, results in less efficient land or water use and reduces enjoyment of outdoor recreation areas.

Cultural Weed Control Methods:

* Use weed free seed to prevent weeds from being introduced.

* Rotate crops with different life cycles or growth habits.

* Utilize timely planting dates to optimize crop competition with weeds.

* Utilize crop competition from plant population, row spacing, varietal growth habit, etc. to suppress weeds.

* Use companion crops to provide weed competition until the desired crop is established.

* Consider the use of cover crops as well as the mulching and alleopathy effect of existing crop residues to suppress weeds.

* Use crop cultivation and shallow tillage operations to control annual and biennial weed seedlings.

* Mow at the proper time to prevent reseeding of all weeds and to have maximum impact on perennial weed root carbohydrate reserves.

* Utilize timely harvest schedules to control weed seed production.

* Use clean feed supplies for livestock to prevent spreading weed seed.

* Control reinfestation sources of weeds on adjacent property such as fence rows, ditch banks, roadways, etc.

* Use hand rouging methods for small infestations.

Biological Weed Control Methods:

* Biological control methods are being studied in Minnesota.

Chemical Weed Control Methods:

* Use herbicides to minimize the effects of weeds on plant growth and productions.

* Use the correct herbicide and rate for the weed spectrum present.

* Consider soil texture, organic matter and soil pH when determining soil applied herbicide rates.

* Consider weed species and stage of growth when determining postemergence herbicide rates.

* Reduce weed resistance development and carryover potential by using the lowest herbicide rate practical, apply uniformly, rotate herbicides and use spot treatment when possible. Select less persistent herbicides if available. Avoid repeated use of herbicides with a similar mode of action.

* Select herbicides that will be least harmful to the environment. Apply these products according to label instruction to minimize surface runoff and leaching. See Table 1 for herbicide characteristics to evaluate environmental impacts.

* Spot spray small infestations before large populations develop.

C. **Pesticide Assessment:** Once the decision has been made to use a chemical pest control method, selection of a product will be made based on its suitability to control the identified target pest. In addition the pesticide selected should be evaluated for its potential to runoff or leach from the application area. Where a water resource concern has been identified, the pesticide evaluation procedure outlined below shall be used.

1. Potential Loss To Leaching.

i. Find the leaching potential for the field soil series from the list in Table 2.

ii. Determine the pesticide leaching potential from the Pesticide Properties found in Table 1. If the pesticide will be applied postemergence onto a canopy of growing crop and weeds that provides 90% or greater ground cover, reduce the potential for leaching by one class.

iii. Use the following matrix to determine a potential rating of 1, 2, or 3.

POTENTIAL PESTICIDE LOSS TO LEACHING

Soil Leaching Potential	Pesticide Leaching Potential			
	Large	Medium	Small	Total Use
High	Potential-1	Potential-1	Potential-2	Potential-3
Intermediate	Potential-1	Potential-2	Potential-3	Potential-3
Nominal	Potential-2	Potential-3	Potential-3	Potential-3

Potential Ratings for Leaching:

Potential-1 This pesticide applied on this soil has a high probability of being lost through leaching. The health hazards of these pesticides to humans or animals should be considered. If the potential danger to health exists, an alternate pesticide or alternative pest management techniques should be selected.

Potential-2 This pesticide applied on this soil has a possibility of being lost through leaching. Additional on-site evaluation is necessary to determine the sensitivity of the water resource and the type of water resource of concern. When a potential water resource problem exists the landuser should consider 1) Alternate pesticides; 2) Use of band application; 3) Cultural control methods; or 4) Biological control methods.

Potential-3 This pesticide applied on this soil has a very low probability of being lost to leaching.

2. Potential Loss To Surface Runoff

i. Find the soil surface loss potential for the field soil series from the list in Table 2. If a soil mapping unit has a slope of 2% or less reduce the soil surface loss potential by one class. If the soil mapping unit has a slope of 10% or more increase the soil surface loss potential by one class.

ii. Determine the pesticide surface loss potential from the Pesticide Properties found in Table 1. If the pesticide will be applied postemergence onto a canopy of growing crop and weeds that provides 90% or greater ground cover, reduce the potential for surface runoff by one class.

iii. Use the following matrix to determine a potential rating of 1, 2, or 3.

POTENTIAL PESTICIDE LOSS TO SURFACE RUNOFF

Soil Surface Loss Potential	PESTICIDE SURFACE LOSS POTENTIAL		
	Large	Medium	Small
High	Potential - 1	Potential - 1	Potential - 2
Intermediate	Potential - 1	Potential - 2	Potential - 3
Nominal	Potential - 2	Potential - 3	Potential - 3

Potential Ratings for Surface Runoff:

Potential-1 This pesticide applied on this soil has a high probability of being lost through surface runoff. The health hazards of these pesticides to humans or animals should be considered. If the potential danger to health exists, an alternate pesticide or alternative pest management techniques should be selected.

Potential-2 This pesticide applied on this soil has a possibility of being lost through surface runoff. Additional on-site evaluation is necessary to determine the sensitivity of the water resource and the type of water resource of concern. When a potential water resource problem exists the landuser should consider 1) Alternate pesticides; 2) Use of band application; 3) Cultural control methods; or 4) Biological control methods.

Potential-3 This pesticide applied on this soil has a very low probability of being lost to surface runoff.

D. Safety And Equipment Operation And Maintenance:

1. Proper handling and application of pesticides will protect the user and the environment from adverse effects. All pesticide users should be encouraged to take the Private Pesticide Applicator's Training offered by the Minnesota Extension Service. This training provides pesticide users with information on how to handle and apply pesticides in a safe and efficient manner. Any person planning to purchase and use pesticides classified as "restricted use" is required to take this training and be certified by the Minnesota Department of Agriculture.

2. Persons planning to apply pesticides through an irrigation system must obtain a chemigation permit through the Minnesota Department of Agriculture. Pesticides used in chemigation shall be labeled for this method of application. All chemigation systems must be

fitted with effective antisipon devices or check valves to prevent backflow into water supplies.

3. All incidents of accidental release of pesticides that may cause adverse effects on the environment shall be reported to the Minnesota Department of Agriculture. Statewide 24 hour emergency numbers are (612) 649-5451 or 1-800/422-0789.

4. Follow label directions and state and federal regulations when transporting pesticides.

5. Store pesticides only in the original container at a location separated from other products such as food, feed, seed etc. preferably in a locked building with appropriate warning signs.

6. Persons using pesticides shall avoid exposure by wearing appropriate clothing. This should always include long-sleeved shirt, long trousers or overalls, liquid-proof gloves, liquid-proof hat, and light weight unlined rubber boots. In some cases the person should also wear an apron or raincoat, goggles and a respiratory device

7. Prevent contaminaton of water supplies by keeping the filler hose or pipe out of the spray tank at all times when adding water to a spray mixture. For added protection install a backflow prevention device. Never leave a spray tank unattended while it is filling to avoid overflow. Locate all pesticide preparation areas and storage and supply tanks at least 150 feet away from and downslope from any water well.

8. Dispose of pesticide wastes, pesticide containers and rinsate from cleaning equipment according to label directions and local, state and federal regulation. Triple rinse empty plastic or metal containers using the following procedure:

   a. Empty the pesticide into the spray tank and let the container drain for 30 seconds.

   b. Fill the container 10-20% full of water or other appropriate solvent and rinse.

   c. Add the rinsate to the sprayer tank and drain the container for 30 seconds.
   d. Repeat steps 2 and 3 two more times.

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e. Puncture and flatten containers so they can not be used again or return to the supplier if so instructed.

9. Completely empty paper containers before disposing of them in a manner consistent with label directions and local state and federal regulations. Outdoor burning of any waste requires a permit from the Minnesota Pollution Control Agency.

10. Calibrate equipment before mixing and loading pesticides. Calibrate equipment at the beginning of each season and each time you change pesticides or application rates. Since nozzle wear can increase application rate and change spray patterns, calibration rates should be checked during the spray season.

VI. The following items shall be considered when planning this practice. Those items marked with an asterisks shall be recorded as minimum documentation requirements.

* 1. Location
* 2. Extent in acres
3. Integrated Pest Management Techniques
* 4. Pest control practices planned
* 5. Environmental assessment when chemical controls will be used in a identified sensitive area.
6. Soil erosion control
7. Equipment operation and maintenance
8. Safety

VII. References:

University of Minnesota
Private Pesticide Applicator's Training Manual
AG-BU-0500 Insecticide Suggestions To Control Insect Pests of Field Crops.
AG-BU-0499 Insecticides
AG-BU-3157 Cultural And Chemical Weed Control In Field Crops

Crop Pest Management Handbook.

Table 1: Pesticide Data Base 1/

Brand Name	Common Name	Soil Sorption Index(K_{OC})	Water Solubility	Soil 1/2 Life	Potential for Movement By: Surface Runnoff	Leaching	Signal Word	Reason If RUP

Table 1: Pesticide Data Base 1/

Brand Name 2/

Common Name 3/

Soil Sorption Index (Koc) 4/

Solubility 5/

Soil 1/2 Life 6/

Surface Runnoff 7/

Leaching 7/

Signal Words 8/9/10/11/

Reason If RUP 10/11/12/13/14/

1/ Source for Soil Sorption Index, Water Solubility, Soil 1/2 Life and Potential for Surface Runoff and Leaching is USDA-ARS Interim Pesticide Properties Data Base, Version 1.0 (August 5, 1988). The data base only provides data for evaluating relative risks to water resources and should not be used to make pesticide use recommendations by itself. The estimated risk to water resources in the data base or derived from the data base should not be considered precise - there are too many variables involved. The estimated risks should be considered first approximations and a guide for better management.

2/ If formulations of the same pesticide have different properties or are classified differently, the formulations are listed.

3/ If a pesticide product contains more than one active ingredient, data for each active ingredients in the product are listed separately. Data on signal word and RUP are listed for the product and not individual active ingredients. Some of these "premixes" may be a mixture of insecticides and fungicides.

4/ Soil sorption is measured by the Koc value. This measures the tendency of pesticides to be strongly attached to soil particle surfaces. Higher values (1000) have a strong attachment to the soil and less tendency to move unless sediment movement occurs. Products with lower values tend to move with water and have potential for percolation or being carried off on runoff water. The "E" code means a probable error of 3X to 5X and a "G" code means a probable error of 10X to 1ooX.

5/ Solubility of a chemical will effect the ease of washoff and leaching through the soil. In general, pesticides with solubilities of 1 or less tend to stay at the soil surface and may be washed off the field in sediment phase runoff. An "E" code means the value is estimated and may be in error up to 3X. A "G" code means the value is a guess and may be in error of 10X to 1ooX.

6/ Half-life, expressed in days, is the time required for pesticides in soil to be degraded so that their concentration decreases by one-half. The values given should only be used as relative indicators of persistence. Half-lives vary by a factor of three or more depending on soil moisture, temperature, oxygen status, soil microbial population and other factors. An "E" code means value is estimated and may be error by a factor of 2X or more. A "G" code means the estimate may be in error by a factor of 3X or more.

7/ Pesticide surface runoff and leaching potential should be used in conjunction with the **Soil Pesticide Interaction Ratings** to evaluate pesticide movement. "Total Use" means the pesticide will not leach with percolating water.

8/ Routes of entry of pesticides to the body are through the skin (dermal), by mouth (oral), and breathed in (inhalation). In addition, pesticides may be skin and/or eye corrosives. Each pesticide product is assigned a signal word based on the most acutely toxic route of entry and level of skin or eye corrosiveness. For example, a pesticide could be given a "Danger" signal word if it is highly acutely toxic if inhaled, but could still be of very low toxicity if taken orally.

Always read and follow all label directions. By following label safety precautions and wearing of proper protective clothing and equipment will greatly reduce pesticide exposure to applicators.

Danger and Dng-Psn:	The product is highly hazardous. The most acutely toxic pesticides will also have a drawing of skull and crossbones and the words "DANGER/POISON" on the label.
Warning:	The product is moderately hazardous.
Caution:	The product is slightly hazardous.

9/ Signal words are designated by product and formulations. Some formulations of the same pesticide may have different signal words.

10/ For more information on signal words and RUP, see the Minnesota Private Pesticide Applicator's Training Manual from the Minnesota Extension Service.

11/ The signal words and RUP statement on the label should always be followed if different from those listed. Always read and follow all label directions.

12/ Restricted Use Pesticides (RUP) are designated by the Environmental Protection Agency when it is felt that a pesticide may generally cause, without additional regulatory restrictions, adverse effects on the environment including injury to the applicator. An RUP classification is available to EPA as an option to placing severe limitations on use or outright banning of a pesticide. Some of the reasons a pesticide is classified as RUP are potential to harm applicators, enter ground and surface waters, harm endangered and other species of plants and animals and if there is a history of accidents. A private pesticide applicator must be certified to purchase and apply RUP.

carcinogenic:	can cause cancer (classified as either potential, possible or probable)
onconogenic:	can cause tumors, which may or may not be cancerous
mutagenic:	can increase mutations; mutations are changes, usually harmful, in inherited genetic material
teratogenic:	can cause birth defects
fetotoxic:	can harm a developing fetus
neurotoxic:	can damage nervous system

avian toxicity: toxic to birds
aquatic organisms: plants and/or animals that live in water

13/ A few pesticides that are classified as RUP have formulations that are not classified as RUP.

14/ Source of RUP information from the master list of Active Ingredients Subject to Restricted Use Classification, December 1, 1988 and First Quarter 1989 Update, United States Environmental Protection Agency, Office of Pesticides and Toxic Substances.

FUNGICIDES 5/15/89

Brand Name	Common Name	Soil Sorption Index(K_{OC})	Water Solubility	Soil 1/2 Life	Potential for Movement By: Surface Runnoff	Potential for Movement By: Leaching	Signal Word	Reason If RUP
Agsco TN-IV	triphenyltin hydroside	Not In Data Base					Dng/Psn	Possible Mutagenic Effects
Agsco MN F	maneb & zinc	1,000G	0.5E	12	Medium	Small	Caution	
Apron	metalaxyl	16	7,100	7	Small	Medium	Caution	
Bayleton	triadimefon	273	260	21	Medium	Medium	Warning	
Benlate	benomyl	2,100	2	100	Large	Small	Caution	
Blitex	maneb	1,000G	0.5E	12	Medium	Small	Caution	
Botran	dicloran	5,000	7	10G	Large	Small	Caution	
Bravo	chlorothalonil	1,380	0.6	20	Large	Small	Warning	
Bravo 500	chlorothalonil	1,380	0.6	20	Large	Small	Warning	
Bravo C/M	chlorothalonil	1,380	0.6	20	Large	Small	Warning	
Bravo 720	chlorothalonil	1,380	0.6	20	Large	Small	Warning	
Bravo 90DG	chlorothalonil	1,380	0.6	20	Large	Small	Danger	
Bravo W75	chlorothalonil	1,380	0.6	20	Large	Small	Danger	
Carbamate	ferbam	300	120	20G	Medium	Medium	Caution	
Champion	copper-fixed						Caution	
Cyprex	iodine acetate	1,000,000E	10,000G	10G	Large	Small	Danger	
Dithane	mancozeb	1,000G	0.5	35	Large	Small	Caution	
Duter	triphenyltin hydroside	Not In Data Base					Dng/Psn	Possible Mutagenic Effects
Dyrene	anilazine	3,000	10G	1	Small	Small	Danger	
Karathane	dinocap	630E	4E	20G	Medium	Small		
Karathane Liquid Concentrate	dinocap	630E	4E	20G	Medium	Small	Warning	
Karathan WD	dinocap	630E	4E	20G	Medium	Small	Caution	
Kelthane	dicofol	8,000,000	1E	60G	Large	Small	Caution	
Kocide	copper hydroxide						Danger	

Brand Name	Common Name	Soil Sorption Index(K_{OC})	Water Solubility	Soil 1/2 Life	Potential for Movement By: Surface Runnoff	Leaching	Signal Word	Reason If RUP
Magnetic 6	sulfur						Caution	
Maneb	maneb	1,000G	0.5E	12	Medium	Small	Caution	
Maneb & Zinc 74	maneb & zinc	1,000G	0.5E	12	Medium	Small	Caution	
Manzate	mancozeb	1,000G	0.5	35	Large	Small	Caution	
Orbit	propiconazole	100E	110	20G	Medium	Medium	Warning	
Penncozeb	mancozeb	1,000G	0.5	35	Large	Small	Caution	
Polyram	metiram	1,000,000G	0.1E	20G	Large	Small	Caution	
Protex	maneb & triphenyltin hydroxide triphenyl tin	1,000G	0.5E	12	Medium	Small	Dng/Psn	Possible Mutagenic Effects
Ridomil	metalaxyl	16	7,100	7	Small	Medium	Warning	
Ridomil 2E	metalaxyl	16	7,100	7	Small	Medium	Warning	
Ridomil MZ58	metalaxyl	16	7,100	7	Small	Medium	Warning	
Ridomil 5G	metalaxyl	16	7,100	7	Small	Medium	Caution	
Ridomil/ Bravo	metalaxyl dicloran	16 5,000	7,100 7	7 10G	Small Large	Medium Small	Warning	
Ronilan	vinclozolin	98E	3	20G	Medium	Medium	Caution	
Rovral	iprodione	500E	13	20G	Medium	Small	Caution	
RubiganE.C.	fenarimal	1,030	14	20G	Medium	Small	Warning	
Super Tin	triphenyltin hydroxide	Not in Data Base					RUP	Possible Mutagenic Effects

Not in Data Base

Brand Name	Common Name	Soil Sorption Index(K_{OC})	Water Solubility	Soil 1/2 Life	Potential for Movement By: Surface Runnoff	Leaching	Signal Word	Reason If RUP
Telone	dichloropene	50	1,000	10	Medium	Medium	Dng-Psn*	Probable Human Carcinogen. Oncogenic, Acutely Toxic by the Oral & Inhalation Routes of Exposure.
Tersan	benomyl	2,100	100	2	Large	Small	Caution	
That	sulfur						Caution	
Thiolu	sulfur						Caution	
Tilt	propiconazole	100E	110	20G	Medium	Medium	Warning	
Tin Man	maneb & triphenyltin hydroxide	1,000G	0.5E	12	Medium	Small	Dng/Psn	Possible Mutagenic Effects
Top Cop	copper	Not in Data Base						
Tribasic								
Triple Tin	triphenyltin hydroxide	Not in Data Base					Dng/Psn	Possible Mutagenic Effects
Vitavax34	hydroxide carboxin	264	170	20G	Medium	Medium	Caution	
Vitavax 200	carboxin thiram						Caution	

Brand Name	Common Name	Soil Sorption Index(K_{OC})	Water Solubility	Soil 1/2 Life	Potential for Movement By: Surface Runnoff	Leaching	Signal Word	Reason If RUP
Vorlex	dichloropropene	50	1,000	10	Medium	Medium	Dng-Psn*	Probable Human Carcinogen. Oncogenic, Acutely Toxic by the Oral & Inhalation Routes of Exposure.

HERBICIDES

Brand Name	Common Name	Soil Sorption Index(K_{OC})	Solubility (ppm)	1/2 Life in Soil	Potential for Movement By: Surface Runnoff	Leaching	Signal Word	Reason if Under RUP
Accelerate	endothall	20E	100,000	2	Small	Small	Danger	
Alanap	naptalam	30	300,000	7	Small	Medium	Warning	
Ally	metsulfuron-methyl	61	2,000	120	Medium	Large	Caution	
Amiben	chloramben	15	300,000E	14	Small	Large	Caution	
Amitrol T	amitrole	200	280,000	14	Medium	Medium	Caution	Oncogenic Potential
Assert	imazethabenz.	35	875	35	Medium	Medium		
Assure	quizalafop-ethyl	100,000E	0.3	140	Large	Small		
Arsenal	imazapyr acid	5E	10,000	90	Large	Small	Caution	
Arsenal	imazapyr amine	15E	1,000,000	90	Small	Large	Caution	
Atrazine	atrazine	160	33	60	Medium	Large	Caution	
Avenge	difenzoquat	100,000	760,000	90	Large	Small	Danger	
Balan	benefin	11,000	0.1	30	Large	Small Use	Caution	
Banvel	dicamba	2	800,000	14	Small	Large	Warning	
Basaqran	bentazon	35	2,300,000	10	Small	Medium		
Betamix	phenmedipham &	2,740	4.7	25	Large	Small	Warning	
	desmedipham	2,000	8	30	Large	Small	Warning	
Betanex	desmedipham	2,000	8	30	Large	Small	Warning	
Bicep	metoachlor	200	530	20	Medium	Medium	Warning	
	atrazine	160	33	60	Medium	Large		
Bladex	cyanazine	168	171	20	Medium	Medium	Warning	Groundwater Contamination; Teratogenicity; Fetaltoxicity
Blazer	acifluorfen	139	900,000	30	Medium	Medium	Danger	
Bolero	thiobencarb	1,000E	30	14	Medium	Small	Caution	
Brominal ME4	bromoxynil	1,000E	50E	14	Medium	Small		

Brand Name	Common Name	Soil Sorption Index(K_{OC})	Solubility (ppm)	1/2 Life in Soil	Potential for Movement By: Surface Runnoff	Leaching	Signal Word	Reason if Under RUP
Broncs	glyphosate &	100,000E	1,000,000	30	Large	Small	Warning	
	alachlor	190	242	14	Medium	Medium	Danger	Oncogenic Potential
Buckle	triallate &	3,600	4	60	Large	Small	Warning	
	trifluralin	1,400	0.3	60	Large	Small	Warning	
Buctril	bromoxynil	1,000E	50E	14	Medium	Small	Warning	
Buctril + Atrazine	bromoxynil &	1,000E	50E	14	Medium	Small	Warning	
	atrazine	160	33	60	Medium	Large		
Butyrac200	2,4-DB amine	20E	200,000	10E	Small	Medium	Danger	
Butyrac	2,4-DB ester	1,000E	50E	10E	Medium	Small	Warning	
Carbyne	barban	Not in Data Base						
Casoron	dichlobenil	224	18	30	Medium	Medium	Caution	
Classic	chlorimuron	20	500E	50	Small	Large	Caution	
Cobra	lactofen							
Command	clomazone	100E	1,100	30	Medium	Large	Warning	
Commence	trifluralin &	1,400	0.3	60	Large	Small	Warning	RUP
	clomazone	100E	1,100	30	Medium	Large	Warning	
Conquest	atrazine &	160	33	60	Medium	Large	Caution	
	cyanazine	168	171	20	Medium	Medium	Warning	Groundwater Contamination; Teratogenicity; Fetaltoxicity
Crossbow	triclopyr & 2,4-D ester	1,000E	50E	10E	Medium	Small	Warning	
Curtail	clopyralid & 2,4-D amine	20E	200,000	10E	Small	Medium	Danger	
Dacthal	DCPA	5,000	.05	30	Large	Small	Caution	
Dowpon M	dalapon	1	800,000	30	Small	Large		
Dual	metolachlor	200	530	20	Medium	Medium	Warning	
Eptam	EPTC	280	375	30	Medium	Medium	Caution	
Eradicane	EPTC	280	375	30	Medium	Medium	Caution	
Eradicane Extra	EPTC	280	375	30	Medium	Medium	Caution	

Brand Name	Common Name	Soil Sorption Index(K_{OC})	Solubility (ppm)	1/2 Life in Soil	Potential for Movement By: Surface Runnoff	Leaching	Signal Word	Reason if Under RUP
Evik	ametryn	388	185	30	Medium	Medium	Caution	
Extrazine II	atrazine &	160	33	60	Medium	Large	Caution	
	cyanazine	168	171	20	Medium	Medium	Warning	Groundwater Contamination; Teratogenicity; Fetaltoxicity
Far-Go	triallate	3,600	4	60	Large	Small	Warning RUP	
Fusilade 2000	fluazifop	3,000E	2	20	Large	Small	Caution	
Galaxie	bentazon &	35	2,300,000	10	Small	Medium		
	aciflourfen	139	900,000	30	Medium	Medium	Danger	
Genate Plus	butylate	540	45	12	Medium	Small		
Genep	EPTC	280	375	30	Medium	Medium	Caution	
Glean	chlorsulfuron	1	2,000E	30	Small	Large	Caution	
Goal	oxyfluorfen	100,000E	0.1	30	Large	Small	Warning	
Gramoxone Super	paraquat	100,000	1,000,000	3600E	Large	Small	Dng-Psn	Human Toxicological Data Other Hazards-Use & Accident History
Harmony	DPX-M6316							
Hoelon	diclofop	48,500	3	10	Large	Small	Danger	Voluntarily Restricted Oncogenicity
Kerb	pronamide	990	15	30	Large	Small	Caution	RUP Possibly lifted this year
Krenite	fosamine	10,000E	1,790,000	7	Medium	Small Use	Caution	
Laddock	atrazine &	160	33	60	Medium	Large	Caution	
	bentazon	35	2,300,000	10	Small	Medium		

Brand Name	Common Name	Soil Sorption Index(K_{OC})	Solubility (ppm)	1/2 Life in Soil	Potential for Movement By: Surface Runnoff	Leaching	Signal Word	Reason if Under RUP
Lariat	alachlor &	190	242	14	Medium	Medium	Danger	Oncogenicity, ground water contamination
	atrazine	160	33	60	Medium	Large	Caution	
Lasso	alachlor	190	242	14	Medium	Medium	Danger	Oncogenicity, ground water contamination
Lasso	alachlor	190	242	14	Medium	Medium	Danger	Oncogenicity, ground water contamination
Microtech Lasso II	alachlor	190	242	14	Medium	Medium	Danger	Oncogenicity, ground water contamination2
Lasso-Atrazine	alachlor &	190	242	14	Medium	Medium	Danger	Oncogenicity, ground water contamination
	atrazine	160	33	60	Medium	Large	Caution	
Lexone	metribuzin	41	1,220	30	Medium	Large	Caution	
Lorox	linuron	863	75	60	Large	Medium	Caution	
MCPA Amine	MCPA amine							
MCPA Ester	MCPA ester							
Nortron	ethofumesate	30	110	50	Medium	Large	Danger	
One Shot	diclofop &	48,500	3	10	Large	Small	Danger	Voluntarily Restricted Oncogenicity
	MCPA & bromoxyl	20E	270,000	14	Small	Large	Danger	Caused Birth Defects in Haboratory Animals

Brand Name	Common Name	Soil Sorption Index(K_{OC})	Solubility(ppm)	1/2 Life in Soil	Potential for Movement By: Surface Runnoff	Leaching	Signal Word	Reason if Under RUP
Option	fenoxaprop	53,700	0.9	5	Large	Small	Use	
Ordram	molinate	110	880	21	Medium	Medium	Warning	
Poast	sethoxydim	50E	1,000	5	Small	Small	Warning	
Pramitol	prometon	300	750	120	Large	Large	Danger	
Preview	metribuzin &	41	1,220	30	Medium	Large	Caution	
	chlorimuron	20	500E	50	Small	Large	Caution	
Princep	simazine	138	3.5	75	Medium	Large	Caution	
Prowl	pendimethalin	24,300	0.5	60	Large	Small	Warning	
Prozine	pendimethalin	24,300	0.5	60	Large	Small	Warning	
	& atrazine	160	33	60	Medium	Large	Caution	
Pyramin	pyrazon	120	400	60	Medium	Large		
Ramrod	propachlor	420	580	7	Medium	Large	Warning	
Ramrod + atrazine	propachlor &	420	580	7	Medium	Large	Warning	
	atrazine	160	33	60	Medium	Large	Caution	
Ranger	glyphosate	10,000E	1,000,000	30	Large	Small	Warning	
Reflex	fomesafen	50E	600,000	180	Medium	Large	Warning	
Rescue	naptalam & 2,4-DB	30	300,000	7	Small	Medium	Warning	
Rhino	butylate &	540	45	12	Medium	Small		
	atrazine	160	33	60	Medium	Large	Caution	
Ro-Neet	cycloate	2,410	85	30	Large	Small	Caution	
Roundup	glyphosate	10,000E	1,000,000	30	Large	Small	Warning	
Scepter	imazaquin	20E	160,000	60	Small	Large	Caution	
Sencor	metribuzin	41	1,220	30	Medium	Large	Caution	
Sinbar	terbacil	41	710	90	Medium	Large	Caution	
Sonalan	ethalfluralin	471,000	0.2E	60E	Large	Small	Warning	
Spike	tebuthiuron	4	2,500	360	Small	Large	Warning	RUP
Stampede CM	propanil & MCPA	20E	270,000	14	Small	Large	Danger	
Stinger	clopyralid							
Storm	bentazon &	35	2,300,000	10	Small	Medium		
	acifluorfen	139	900,000	30	Medium	Medium	Danger	
Surflan	oryzalin	2,700	2.5	60	Large	Small	Caution	

Brand Name	Common Name	Soil Sorption Index(K_{OC})	Solubility (ppm)	1/2 Life in Soil	Movement By: Surface Runnoff	Movement By: Leaching	Signal Word	Reason if Under RUP
Sutant	butylate	540	45	12	Medium	Small		
Sutazine +	butylate &	540	45	12	Medium	Small		
	atrazine	160	33	60	Medium	Large	Caution	
2,4-D Amine	2,4-D amine	20E	200,000	10E	Small	Medium	Danger	
2,4-D Ester	2,4-D ester	1,000E	50E	10E	Medium	Small	Warning	
Tackle	acifluorfen	139	900,000	30	Medium	Medium	Danger	
Tandem	tridiphane	5600	1.8	28	Large	Small	Warning	
Thistrol	MCPB	600	5	14	Medium	Small	Caution	
Tillam	pebulate	190	60	14	Medium	Medium	Caution	
Tordon 22K	picloram	16	200,000G	90	Small	Large	Caution	Environmental movement off target; hazard to Non-Target Plants
Treflan	trifluralin	1,400	0.3	60	Large	Small	Warning	
Turbo	metolachlor &	200	530	20	Medium	Medium	Warning	
	metribuzin	41	1,220	30	Medium	Large	Caution	
Velpar	hexazinone	11	33,000	60	Small	Large	Warning	
Vernam	vernolate	200	90	12	Medium	Medium	Caution	
Weedar	MCPA	20E	270,000	14	Small	Large	Danger	
Weedmaster	dicamba &	2	800,000	14	Small	Large	Warning	
	2,4-D amine	20E	200,000	10E	Small	Medium	Danger	
Weedone 2,4-DP	dichlor prop-ester	1000E	50E	10	Medium	Small	Caution	
Whip	fexoxaprop	53,700	0.9	5	Large	Small Use	Warning	

INSECTICIDES 5/15/89

Brand Name	Common Name	Soil Sorption Index	Solubility	Soil 1/2 Life	Potential for Movement By: Surface Runnoff	Leaching	Signal Word	Reason If RUP
Agrox DL Plus	diazinon lindane captan	85 1,100	40 7	30 90	Medium Large	Large Medium	Warning	
Ambush	permethrin	10,600	0.2	30E	Large	Small	Warning	Highly Toxic to Aquatic Organisms, Oncogenicity
Asana 1.9E	esfenvalerate	100,000E	0.1E	50E	Large	Small	Danger	Possible Adverse Effects on Aquatic Organisms
Asana XL 0.66E	esfenvalerate	100,000E	0.1E	50E	Large	Small	Warning	Possible Adverse Effects on Aquatic Organisms
Azinphis-M	azinphos-methyl	1,000	29	40	Large	Small	Dng-Psn	Human Inhalation Hazard; Acute Toxicity; Hazard to Avian, Aquatic & Mammalian Species
Bolstar	sulprofos	550	5	14	Medium	Small	Warning	Wildlife Hazard
Broot	trimethacarb	200E	58	10G	Medium	Small	Caution	
Captan/ methoxychlor	captan/ methoxchlor	Not in Data Base					Danger	
Carbaryl	carbaryl	229	40	7	Medium	Small	Caution	
Carzol	formetanate	100,000	500,000	20G	Large	Small	Dng-Psn	

Brand Name	Common Name	Soil Sorption Index	Solubility	Soil 1/2 Life	Potential for Movement By: Surface Runnoff	Leaching	Signal Word	Reason If RUP
Comite	propargyte	8,000E	0.5	20G	Large	Small	Danger	
Counter	terbufos	3,000	12	5	Medium	Small	Dng-Psn	Acute Oral & Dermal Toxicity; Residue Effects on Avian Species
Cygon	dimethoate	8	25,000	7	Small	Medium	Warning	
Cythion	malathion	1797	145	1	Small	Small	Caution	
Diazinon	diazinon	85	40	30	Medium	Large	Warning	
Diazinon 14G	diazinon	85	40	30	Medium	Large	Caution	
Dizazinon 4E	diazinon	85	40	30	Medium	Large	Warning	
Diazinon 7E	diazinon	85	40	30	Medium	Large	Caution	
Diazinon 50W	diazinon	85	40	30	Medium	Large	Warning	
Diazinon AG500	diazinon	85	40	30	Medium	Large	Warning	
Dicofol	dicofol	8,000,000	1E	600	Large	Small	Caution	
Dimethoate	dimethoate	8	25,000	7	Small	Medium	Warning	
Dimilin	diflubenzuron	6790	0.2	10	Large	Total Use	Caution	Hazard to Wildlife
Dipel	bacillus thuringiensis	Not Applicable----------					Caution	
Di Syston	disulfoton	2,000	25	4	Medium	Small	Dgn-Psn	Acute Dermal & Inhalation Toxicity
Dyfonate	fonofos	680	13	45	Large	Medium	Dng-Psn	Acute Dermal Toxicity
Dylox	trichlorfon	2	154,000	27	Small	Large	Danger	
Endocide	endosulfan	200,000	0.3	43	Large	Small	Dng-Psn	

Brand Name	Common Name	Soil Sorption Index	Solubility	Soil 1/2 Life	Potential for Movement By: Surface Runnoff	Leaching	Signal Word	Reason If RUP
Endocide	endosulfan	200,000	0.3	43	Large	Small	Dng-Psn	
Plus	parathion	1,000E	24	14	Medium	Small	Dng-Psn	Inhalatioin Hazard to Humans; Acute Dermal Toxicity; Residue Effects on Mammalian, Aquatic and Avian Species. Accident History
Endosulfan	endosulfan	200,000	0.3	43	Large	Small	Dng-Psn	
Enhance	carboxin							
Plus	maneb	1,000	0.5E	12	Medium	Small	Warning	
	lindane	1,100	7	90	Large	Medium		
Furadan	carbofuran	29	350	30	Small	Large	Dng-Psn	Acute Inhalation Toxicity
Furadan 3G	carbofuran	29	350	30	Small	Large	Warning	Avian Toxicity
Furadan 4F	carbofuran	29	350	30	Small	Large	Dng-Psn	Acute Oral & Inhalation Toxicity
Furadan 10G	carbofuran	29	350	30	Small	Large	Warning	Avian Toxicity
Furadan 15G	carbofuran	29	350	30	Small	Large	Warning	Avian Toxicity
Germate Plus	carboxin							
	diazinon	85	40	30	Medium	Large		
	lindane	1,100	7	90	Large	Medium	Caution	

Brand Name	Common Name	Soil Sorption Index	Solubility	Soil 1/2 Life	Potential for Movement By: Surface Runnoff	Leaching	Signal Word	Reason If RUP
Guthion	azinphos-methyl	1,000	29	40	Large	Small	Dng-Psn	Human Inhalation Hazard; Acute Toxicity; Hazard to Avian, Aquatic & Mammalian Species
Imidan	phosmet	740	25	20	Medium	Small		Warning
Isotox	lindane	1,100	7	90	Large	Medium	Danger	Possible Oncogenic
Isotox Lindane #200	lindane	1,100	7	90	Large	Medium	Danger	Possible Oncogenic
Isotox Lindane 25%	lindane	1,100	7	90	Large	Medium	Danger	Possible Oncogenic
Isotox Seed Treater(F)	lindane/ captan	1,100	7	90	Large	Medium	Danger	
Javelin	Bacillus thuringiensis	Not Applicable----------					Caution	
Lannate	methomyl	28E	57,900	8	Small	Medium	Dng-Psn	Residue Effects of Mammalian Species; Other Hazards-Accident History
Lannate 90SP	methomyl	28E	57,900	8	Small	Medium	Dng-Psn	
Lannate 1.8L,2.4LV	methomyl	28E	57,900	8	Small	Medium	Dng-Psn	

Brand Name	Common Name	Soil Sorption Index	Solubility	Soil 1/2 Life	Potential for Movement By: Surface Runnoff	Leaching	Signal Word	Reason If RUP
Lanox	methomyl	28E	57,900	8	Small	Medium	Dng-Psn	Reside Effects of Mammalian Species; Other Hazards - Accident History
Larvin	thiodicarb	300E	35	7	Medium	Small	Warning	
Lindane	lindane	1,100	7	90	Large	Medium	Danger	
Lorsban	chlorpyrifos.	6,070	2	30	Large	Small	Warning	
Lorsban 4E	chlorpyrifos	6,070	2	30	Large	Small	Warning	
Lorsban 15G	chlorpyrifos	6,070	2	30	Large	Small	Caution	
Malathion	malathion	1,797	145	1	Small	Small	Caution	
Malathion Methoxychlor	malathion methoxychlor	1,797	145	1	Small	Small	Caution	
Maneb-Lindane Seed Protectant	maneb lindane	1,100	7	90	Large	Medium	Caution	
Metasystox-R	demeton-s-methyl 51	33,000	30E	Medium	Large	Dng-Psn	RUP	
Methoxychlor	methoxychlor	Not in Data Base						
Caution								

Brand Name	Common Name	Soil Sorption Index	Solubility	Soil 1/2 Life	Potential for Movement By: Surface Runnoff	Leaching	Signal Word	Reason If RUP
Methyl Parathion	methyl-parathion	5,100	60	5	Medium	Total Use	Dng-Psn	All Foliar Applications; Restricted Based on Residue; Effects on Mammalian, Bees & Avian Species; Acute Dermal Toxicity
Mevinphos	mevinphos	1	600,000	3	Small	Medium	Dng-Psn	Acute Dermal Toxicity; Residue Effects on Mammalian & Avian Species
Mocap	ethoprop	120	700	30	Medium	Large	Dng-Psn	Acute Dermal Toxicity
Mocap 10G	ethoprop	120	700	30	Medium	Large	Warning	
Mocap 15G	ethoprop	120	700	30	Medium	Large	Dng-Psn	Acute Dermal Toxicity
Mocap 20G	ethoprop	120	700	30	Medium	Large	Dng-Psn	Acute Dermal Toxicity
Mocap 4EC	ethoprop	120	700	30	Medium	Large	Dng-Psn	Acute Dermal Toxicity
Monitor	methamidophos	780	100,000	6	Medium	Small	Dng-Psn	Acute Dermal Toxicity; Residue Effects on Avian Species

Brand Name	Common Name	Soil Sorption Index	Solubility	Soil 1/2 Life	Potential for Movement By: Surface Runnoff	Leaching	Signal Word	Reason If RUP
Nudrin	methomyl	28E	57,900	8	Small	Medium	Dng-Psn	Residue Effects on Mammalian Species; Other Hazards-Accident History
Orthene	acephate	100	650,000	3	Small	Small	Caution	
Parathion Aqua 8	parathion	1,000E	24	14	Medium	Small	Dng-Psn	Inhalation Hazard to Humans; Acute Dermal Toxicity; Residue Effects of Mammalian, Aquatic, & Avian Species; Accident History
Parathion	parathion	1,000E	24	14	Medium	Small	Dng-Psn	Inhalation Hazard to Humans; Acute Dermal Toxicity; Residue Effects of Mammalian, Aquatic, & Avian Species; Accident History

Brand Name	Common Name	Soil Sorption Index	Solubility	Soil 1/2 Life	Potential for Movement By: Surface Runnoff	Leaching	Signal Word	Reason If RUP
methyl-parathion	methyl-parathion	5,100	60	5	Medium	Total Use	Warning	All Foliar Applications; Restricted Based on Residue; Effects on Mammalian & Avian Species; Acute Dermal Toxicity
Penncap-M	methyl parathion	5,100	60	5	Medium	Total Use	Warning	All Foliar Applications; Restricted Based on Residue; Effects on Mammalian & Avian Species; Acute Dermal Toxicity

Brand Name	Common Name	Soil Sorption Index	Solubility	Soil 1/2 Life	Potential for Movement By: Surface Runnoff	Leaching	Signal Word	Reason If RUP
Phorate	phorate	1,000	50	90	Large	Medium	Dng-Psn	Acute Oral & Dermal Toxicity for Granulard, Residue Effects on Avian & Mammalian Species (Foliar Application of Liquid Formulation Only), Effects on Aquatic Organisms
Phosdrin	mevinphos	1	600,000	3	Small	Medium	Dng-Psn	Acute Dermal Toxicity; Residue Effects on Mammalian & Avian Species
Parathion	parathion	1,000E	24	14	Medium	Small	Dng-Psn	Inhalation Hazard to Humans; Acute Dermal Toxicity; Residue Effects of Mammalian, Aquatic & Avian Species; Accident History

Brand Name	Common Name	Soil Sorption Index	Solubility	Soil 1/2 Life	Potential for Movement By: Surface Runnoff	Leaching	Signal Word	Reason If RUP
Phosphamidon	phosphamidon	1	1,000,000	10G	Small	Large	Dng-Psn	Acute Dermal Toxicity, Residue Effects on Mammalian and Avian Species
Pounce	permethrin	10,600	0.2	30E	Large	Small	Warning	Highly Toxic to Aquatic Organisms, Oncogenicity
Pydrin	fenvalerate	100,000	0.1	50	Large	Small	Warning	Possible Adverse Effects on Aquatic Organisms
Rampart	phorate	1,000	50	90	Large	Medium	Dng-Psn	Acute Oral & Dermal Toxicity for Granulard, Residue Effects on Avian & Mammalian Species (Foliar Application of Liquid Formulation Only), Effects on Aquatic Organisms
Scout	tralomethrin	Not in Data Base					Danger	Toxicity to Aquatic Organisms
Sevin	carbaryl	229	40	7	Medium	Small	Caution	

Brand Name	Common Name	Soil Sorption Index	Solubility	Soil 1/2 Life	Potential for Movement By: Surface Runnoff	Leaching	Signal Word	Reason If RUP
Somanil	methidathion	780	240	21	Medium	Small	Dng-Psn	Residue Effects on Avian Species
Supracide	methidathion	780	240	21	Medium	Small	Danger	Residue Effects on Avian Species
Temik	aldicarb	30	6,000	30	Small	Large	Dng-Psn	Other Hazards-Accident History
Thimet	phorate	1,000	50	90	Large	Medium	Dng-Psn	Acute Oral & Dermal Toxicity for Granulard, Residue Effects on Avian & Mammalian Species (Foliar Application of Liquid Formulation Only), Effects on Aquatic Organisms
Thiodan	endosulfan	200,000	0.3	43	Large	Small	Dng-Psn	
Triple Seed Protectant	captan/ diazinon	85	40	30	Medium	Large		
	lindane	1,100	7	90	Large	Medium	Danger	
Vitavax Maneb Lindane	carboxin maneb lindane	1,100	7	90	Large	Medium	Caution	

Table 2: Soil Ratings for Determining Water Pollution Risk for Pesticides

Soils Series	Surface Texture	O.M.	Depth to Water Table	Leaching Potential	Runoff Potential
Barnes	L, SIL, CL	3-7	6.0	Intermediate	Intermediate
Barnes	SL	2-7	6.0	Intermediate	Intermediate
Barnes,Med.Perm.	L,SIL,FSL,SCL	2-5	6.0	Intermediate	Intermediate
Barnes, Stony	L,SIL,FSL,CL	3-7	6.0	Intermediate	Intermediate
Beardon	LICL,CL,L,SIL,SIC	3-7	2.0-4.0	Intermediate	Intermediate
Burnsville	SL,COSL,L	0.5-1	6.0	High	Intermediate
Chelsea	LFS,LS,FS,S	0.5-1	6.0	High	Nominal
Clarion	L,SIL,SL	3-5	6.0	Nominal	Intermediate
Clarion	CL,SICL	2-3	6.0	Intermediate	Intermediate
Downs	SIL	2-3	6.0	Intermediate	Intermediate
Downs	SICL	1-2	6.0	Intermediate	Intermediate
Dunbarton	SIL	1-3	6.0	Nominal	High
Dunbarton	SICL	1-2	6.0	Nominal	High
Eyota	Sl,FSL	2-3	6.0	High	Nominal
Eyota	LS,LFS	102	6.0	High	Nominal
Mooselake	MPT,HM	25	0 to 1.0	Nominal	-
Mooselake	Muck,SP,Peat,FB	0-0	0 to 1.0	High	-
Sioux Loamy	L,SL,GR-SL	1-3	6.0	High	Nominal
Sioux Sandy	LS,LCOS,GR-LCOS	1-2	6.0	High	Nominal
Woodslake	CL,SICL,C	3-5	0.5 to 2.0	Nominal	Nominal
Zimmerman	LFS,FS	0.5-1	6.0	High	Nominal

(The complete list of soil ratings will be filed in Section II of FOTG. Each Field Office will develop a Table 2 of Soil Series for their location and attach it to the Standard)

3.3.4 New York

DRAFT

NEW YORK STANDARD-DRAFT

USDA-SCS, New York FOTG
January 31, 1989

PRACTICE NAME: Nutrient Management

UNIT OF PRACTICE: Acres

PRACTICE CODE: to be assigned

I. DEFINITION: Managing the amount, source, form, placement and timing of applications of plant nutrients such as nitrogen, phosphorous, potassium, and other elements needed for plant growth and crop production.

II. SCOPE: This standard gives guidelines for managing plant nutrients. Sources of plant nutrients include inorganic fertilizers, soil reserves, crop residues and organic wastes. This standard does not include using or disposing of hazardous waste.

III. PURPOSE: To supply adequate plant nutrients for optimum crop yield, minimize entry of nutrients to surface and ground water, maintain or improve the chemical and biological condition of the soil, and to employ safe handling practices.

IV. CONDITIONS WHERE PRACTICE APPLIES: On all lands where plant nutrients are managed.

V. PLANNING CONSIDERATIONS

A. Effect on Water Quality. This practice reduces the potential for pollution of surface or ground water by nutrients through balancing the quantity of plant-available nutrients with that needed to produce an optimum crop yield; and through proper application methods that limit nutrient movement to surface or ground water.

B. General Management Considerations

1. Development of a nutrient budget for the proposed crop considering
   - plant-available soil nutrient levels,
   - realistic yield goals for given soil type and climatic conditions,
   - nutrient additions, and
   - nutrient uptake efficiency,

   as implemented through the Cornell Soil Test System recommendations.

2. Insurance of proper placement and uniform application. Proper placement may include nutrient injection, broadcast application, incorporation, banding, etc.

3. Manipulate timing, placement and method of application of nutrients such as to minimize the potential of contamination of surface and groundwater. This includes split applications, the use of waste spreading schedules, etc.

4. Optimize nutrient uptake and plant growth through
   - proper seedbed preparation and planting
   - timely planting and harvest
   - maintenance or development of an optimum plant growth environment through water management (surface or subsurface drainage and/or irrigation), prevention or mitigation of soil compaction, maintenance of optimum soil pH levels, and maintenance of optimum (not excessive) levels of other soil nutrients.

C. Environmental Considerations.

1. Soils

a. Consider soil-nutrient interactions when specifying nutrient management practices. The potential for leaching of nitrogen to groundwater is greater in permeable soils, especially those with shallow water tables. Phosphorus, nitrogen and wastes are susceptible to surface loss on soils with high surface loss potential. Erodible soils on long and steep slopes generally exhibit the greatest potential for surface loss.

b. Avoid excessive water percolation in soils where nutrient leaching to groundwater or drain lines is of concern. Avoid excessive surface runoff on soils where nutrient surface loss is of concern.

2. Water Resources

Determine if the field is located in a water resource concern area for nutrients, either for groundwater or surface water quality, by referring to the County Resources Inventory Water Quality Map.

3. Climate

Avoid surface-applied nutrient additions before high-intensity rainfall, especially when the soil is near saturation, to prevent surface loss.

VI. SPECIFICATIONS

A. Nutrient Management Practices

1. Nutrient Testing

a. Determine the cropping sequence. Specify the number of years for each crop in the rotation and identify cover and manure crops, and the legume percentage of recent pasture and hay sod. Describe the crop residue use as specified in the appropriate SCS standard. Otherwise, define what is adequate.

b. Determine the soil series and map unit symbol, depth of tillage, drainage modification, and waste spreading schedule.

c. If nutrient additions are planned, soil and/or plant tissue testing should be performed as specified in the grower's guide (Cornell Recommends) through
   - collection of representative samples
   - submission of samples to the Cornell Nutrient Analysis Laboratory (or other laboratories that employ Cornell nutrient recommendations), with inclusion of the requested field and crop information.

d. Follow the fertilizer recommendations provided with the nutrient test results. Use fertilizer compounds that do not cause crop injury or otherwise adversely affect plant growth.

2. Soil-Fertilizer Interactions

a. Where groundwater is a resource concern, determine the potential loss of nitrate due to leaching:

Determine the soil hydraulic group from the SOILS-5 data base.

Find the Leaching Index (LI) from the Leaching Index Maps for each soil mapping component, as described in the Soil Rating for Nitrate and Soluble Nutrients in the FOTG.

A LI below 2 inches indicates that the potential for soluble nutrient leaching below the root zone is low.

A LI between 2 and 10 inches indicates that the potential for soluble nutrient leaching below the root zone is intermediate. Additional site evaluations are in order. Practices specified under LI's greater than 10

inches should be considered.

A LI greater than 10 inches indicates that the potential for soluble nutrient leaching below the root zone is high. The following practices shall be implemented to reduce the potential for nitrate leaching to groundwater.

- Avoidance of nitrate leaching from excessive irrigation through proper irrigation scheduling practices.

- Strict timing of application of nitrogen in accordance with plant uptake needs. This includes the use of split applications, waste spreading schedules, avoidance of fall nitrogen applications, etc.

- Consideration of the use of slow-release and/or non-nitrate based fertilizer formulations.

- Consideration of management practices such as cover crops to take up excess nutrients and prevent their movement out of the root zone.

Where surface water is a resource concern, determine the potential for loss of nutrients due to surface runoff:

Find the surface loss potential for each soil mapping component from the Soil Ratings for Determining Water Pollution Risk in the FOTG.

If the soil mapping component has a slope equal or less than 2%, reduce the soil surface loss potential by one unit, i.e. INTERMEDIATE to NOMINAL.

A NOMINAL potential indicates that surface loss of nutrients is not a major concern.

If the potential is INTERMEDIATE, a possibility exists for nutrient loss through surface runoff. Additional site evaluations are in order. Practices specified under HIGH potentials should be considered.

If the potential is HIGH, a high probability exists for nutrient loss through surface runoff. The following practices shall be implemented to avoid nutrient loss:

- Avoidance of high application rates of irrigation water, which may exceed infiltration rates and induce surface runoff.

- Planning of conservation practices to control erosion and runoff.

- Implementation of animal waste management practices as specified in the Waste Utilization Standard (633) and Cornell Field Crops and Soils Handbook.

- Consideration of incorporation of surface-applied fertilizers.

B. Operations, Safety and Maintenance

Nutrient applicators must:

Be fully trained in the handling of the nutrient materials and the proper and safe operation of application equipment.

Maintain application equipment in proper working condition.

Calculate and carefully measure the required quantity of nutrients to be applied.

Insure proper calibration of application equipment.

Only treat target areas.

If nutrients require dilution with water, insure prevention of backsiphoning to water supplies.

Fit effective anti-siphon devices or check valves on fertigation systems to prevent backflow into water supplies.

Comply with federal, state and local laws and regulations regarding nutrient applications.

Avoid unnecessary exposure to chemical fertilizer and organic wastes. Wear protective clothing when appropriate.

When cleaning equipment after nutrient application, remove and save fertilizer and waste in appropriate manner. If system is flushed, be sure waste water is kept away from high runoff areas, ponds, lakes, streams and other water bodies.

Dispose of fertilizer containers in an appropriate manner.

VII. SUPPORT DATA FOR DOCUMENTATION

Field location.
Acres
Potential water quality problems -
- leaching potential (LI greater than 10)
- surface water (High potential for runoff)
Final nutrient plan.

VII. REFERENCES

Cornell Recommends for all commodities

Cornell Field Crops and Soils Handbook

Irrigation Scheduling by Cassel

Extension publications on nutrients and nutrient movement.
Others?

DRAFT

NEW YORK STANDARD - DRAFT

USDA-SCS, New York

Field Office Tech. Guide

Practice Name: Pest Management

January 24, 1989

Unit of Practice: Acres

Practice Code: 514

I. Definition: Managing pests for optimum crop production and minimal degradation of the environment.

II. Scope: This standard gives guidelines for managing pests on all lands and waters used for crop production. Non-agricultural and indoor pest management is excluded.

III. Purpose: To control target organisms and minimize contamination of soil, water, air and non-target organisms through safe and prudent pest management.

IV. Conditions Where Practice Applies: On all lands and waters used for crop production where pest management is needed.

V. Planning Considerations:

A. The effect on Water Quality - This practice reduces the potential of pesticides becoming pollutants of surface and ground water through:

1. Reduction of the total applied quantity of a given pesticide.

2. Use of proper application rates.

3. Targeted pest control.

4. Use of cultural practices that substitute for or complement pesticide use.

5. Selection of pesticides with use of environmental considerations.

B. General Pest Management Considerations:

1. Apply the principles of Integrated Pest Management (IPM) including:

- Evaluation of the options for chemical, biological, and/or cultural pest control methods.

- Basing treatment on threshold populations as established by:

1. Field monitoring,

2. Field and crop history, or

3. Forecasting methods.

- Optimization of timing of crop planting and harvesting.

2. Use crop and soil management practices that provide for vigorous plant growth. Healthy plants are generally more tolerant of pests. Optimize nutrient uptake and plant growth through,

a. proper seedbed preparation and planting

b. maintenance or development of an optimum plant growth environment through

- water management (surface and subsurface drainage and/or irrigation),
- avoidance of soil compaction,
- maintenance of optimum soil pH levels
- maintenance of optimum soil nutrient levels.

3. Manipulate timing, placement and method of pest control such as to minimize the potential for negative environmental impacts.

C. Environmental Considerations

1. Soils

a. Consider erosion control practices that reduce movement of pesticides off target sites. This includes erosion

control practices to reduce the loss of chemicals in solution or suspension and sod filter strips to intercept overland flow.

b. Consider soil/pesticide interaction when selecting a pesticide. Pesticides are evaluated on solubility, soil sorption index, degradation rate, formulation and application method. Soils are evaluated on permeability, depth to groundwater, organic matter content, erodibility, and topography.

c. Determine if the field is located in a water resource concern area for pesticides, either groundwater or surface water quality by referring to the County Resource Inventory Water Quality Maps.

2. Climate

a. Avoid pesticide application when weather conditions are adverse for proper placement, such as spraying under windy conditions, surface application before high intensity rainfall and application on saturated soil. Consult the label.

b. For volatile pesticides, avoid application under high temperature conditions. Consult the label.

c. Consider pesticide efficacy on pests as affected by temperature and/or moisture conditions. Pests under

dormant or stressed conditions may be less susceptible to pesticide treatment.

d. For soil fumigants, avoid application under saturated and/or cold soil conditions. Consult the label.

3. Non-target organisms

a. Some pesticides are highly toxic to non-target organisms. Precautions should be taken to avoid contact with vulnerable organisms through proper application methods and timing of application.

b. Insure knowledge of local and/or state regulations on endangered or threatened species and adjust pesticide selection accordingly.

4. Consider avoidance of the long term use of pesticides of similar chemistry to reduce the potential for pest resistance.

D. Pesticide laws and regulations - Pesticide applicators must abide by Federal and State laws and regulations.

1. Pesticides must be applied according to their label.

2. Pesticide applicators must be certified in the appropriate (sub)category to purchase and apply "restricted use" pesticides.

3. Pesticide users must be aware of and abide by Department of Transportation regulations on transportation of pesticides.

4. Certified applicators must keep records showing pesticide purchase, use, dosage, method of application, date, crops and place(s) treated for three years. They must be available for inspection.

5. Follow regulations on notification, posting and re-entry per label.

6. No pesticide application is to be permitted that will expose any person to pesticides either directly or through drift, except for those involved in the application. Take special care near housing developments, schools, etc.

7. Unwanted pesticides and containers, pesticide waste (including rinse and wash water, spilled material,etc.) must be disposed of according to State rules and regulations.

VI. Specifications:

A. Pest Control Practices:

Integrated Pest Management (IPM) is the optimum approach to effective, economical and environmentally responsible pest management. A good IPM program helps the decision maker consider the cost, risks and benefits associated with a given course of action. These actions may include chemical, cultural and/or biological control methods.

The most common pests affecting crop growth and production are diseases, insects and weeds. Selected methods for each of these pest categories will include one or more of the following:

1. Disease

a. Cultural-

- Removal and/or burn of infected or dead plant portions.

- Control of alternate hosts and wild hosts.

- Selection of cultivars or varieties with resistance to primary pest(s).

- Crop residue management-Incorporation into the soil or removal.

- Improved soil drainage and/or irrigation.

- Improved air drainage through adjusting row gradient or growing on ridges.

- Practice of good planting techniques.

- Avoidance of mixing susceptible and nonsusceptible varieties.

- Practice of good weed control.

- Maintenance of optimum soil fertility levels.

- Timely harvest of the crop.

- Using appropriate crop rotation.

- Selection of appropriate fields for the desired crop.

- Suppression of disease transmitting organisms.

- Use of disease free seeds or plants.

- Use of good sanitation, clean equipment, clean tools, and clean materials.

b. Chemical

- See appropriate grower's guides (Cornell Recommends) or the current New York State Pesticide Recommendations, as published by Cornell Cooperative Extension. When providing a grower with a Cornell University pesticide recommendation, include a disclaimer statement reading, "Every effort has been made to provide correct, complete, and up-to-date pesticide recommendations. Nevertheless, changes in pesticide

regulations occur constantly and human errors are still possible. These recommendations are not a substitute for pesticide labeling. Please read the label before applying any pesticide."

- If appropriate, use adjuvants to increase pesticide efficacy and to keep the pesticide on the target pest.

c. Biological

- Utilize natural pest predators or parasites. However, many diseases have no known biological controls.

2. Insects

a. Cultural

- Practice of timely planting and harvesting. Also, consider different variety maturity groups to optimize timing.

- Use of appropriate crop rotations.

- Use of proper manure and organic matter management practices.

- Improvement of drainage.

- Utilization of traps.

- Use of seed treatments.

- Practice of good weed control.

- Control of alternate hosts and wild hosts.

- Practice of residue management such as plowing down or shredding of infested residue.

- Pruning and/or sucker growth control.

- Maintenance of optimum soil fertility levels.

- Selection of cultivars or varieties with resistance to primary pest(s). Also consider maturity groups.

- Mowing of surrounding vegetation.

- Practice of good harvest techniques to minimize crop cuts and bruises which may provide access for the insect.

b. Chemical

- See appropriate grower's guide (Cornell Recommends) or the current New York State Pesticide Recommendations, as published by Cornell Cooperative Extension. When providing a grower with a Cornell University pesticide recommendation, include a disclaimer statement reading, "Every effort has been made to provide correct, complete, and up-to-date pesticide recommendations. Nevertheless, changes in pesticide regulations occur constantly and human errors are still possible. These recommendations are not a substitute for pesticide labeling. Please read the label before applying any pesticide."

- If appropriate, use adjuvants to increase pesticide efficacy and to keep the pesticide on the target pest.

c. Biological

- Utilize natural pest predators or parasites. However, many insects have no known biological control.

- Careful selection of pesticides so as not to reduce pest predators and parasites.

3. Weeds

a. Cultural

- Use appropriate crop rotations, including consideration for planned allelopathy.

- Improvement of drainage.

- Maintenance of optimum soil fertility levels.

- Timely planting and harvesting.

- Mechanical cultivation and/or hand weed control.

- Ridging or hilling.

- Consideration of combined mechanical and chemical weed control including banded herbicide application.

b. Chemical

- See appropriate grower's guides (Cornell Recommends) or the current New York State Pesticide Recommendations, as published by Cornell Cooperative Extension. When providing a grower with a Cornell University pesticide recommendation, include a disclaimer statement reading, "Every effort has been made to provide correct, complete, and up-to-date pesticide recommendations. Nevertheless, changes in pesticide regulations occur constantly and human errors are still possible.

These recommendations are not a substitute for pesticide labeling. Please read the label before applying any pesticide."

- If appropriate, use adjuvants to increase pesticide efficacy and to keep the pesticide on the target pest.

c. Biological

- Individual weeds may have associated insects or diseases which may contribute to "weed" control; most are not well documented. Many weeds have no known biological control.

4. Other pests (Other Arthropods, Mollusk, etc.)

a. Cultural

- Maintenance of vegetation-free zone under plant canopy.

- Regular mowing of surrounding areas.

- Installation of mesh guards around base of trees.

- Installation of fences around fields/orchards.

- Removal of fruit drops and other plant residues which may serve as food to pests.

- Pruning to reduce pest access.

- Removal of other food sources to minimize pest attraction to the crop.

b. Chemical

- See appropriate grower's guides (Cornell Recommends) or the current New York State Pesticide Recommendations as published by Cornell Cooperative Extension. When providing a grower with a Cornell University pesticide recommendation, include a disclaimer statement reading, "Every effort has been made to provide correct, complete, and up-to-date pesticide recommendations. Nevertheless, changes in pesticide regulations occur constantly and human errors are still possible. These recommendations are not a substitute for pesticide labeling. Please read the label before applying any pesticide."

- If appropriate, use adjuvants to increase pesticide efficacy and to keep the pesticide on the target pest.

c. Biological

- Use of pest predators, parasites, scents, etc.

However, many pests have no known biological control.

B. Environmental Considerations for Selection of Pesticides.

To estimate site specific water quality risk, the chemical and physical properties of a pesticide must be considered in relation to soil and topographic characteristics.

1. Utilize the Field Office Technical Guide (FOTG) Soils Ratings to determine the soil's potential for leaching and surface runoff.

2. Subsequently, use the FOTG Pesticide Data Base to determine the pesticide potential for leaching and surface runoff.

3. Utilize the matrices in the Soil-Pesticide Interaction Ratings to determine the potential for pesticide loss to leaching and surface runoff.

4. Follow the guidelines for interpreting the potential pesticide loss ratings.

C. Operations, Safety and Maintenance:

Pesticide users must:

1. Be fully trained in the proper handling of chemicals and the proper and safe operation of application equipment.

2. Read the safety considerations on the label and have an emergency treatment plan and facility available.

3. Read and have available the appropriate Material Safety Data Sheet (MSDS).

4. Maintain application equipment in proper condition.

5. Calculate and carefully measure the required quantity of pesticide to avoid leftover tank mixes.

6. Calibrate equipment before mixing and loading pesticides. Calibrate equipment at the beginning of each season and each time one changes pesticides or application rates. Since nozzle wear can increase application rate and change spray patterns, calibration rates should be checked during the spray season.

7. Store pesticides in properly labeled containers. Store containers in locked buildings with appropriate warning signs and ventilation.

8. Dispose of leftover material and containers according to label requirements and State laws and regulations.

9. Wear appropriate protective clothing when handling or applying pesticides.

10. Practice good hygiene. Do not smoke, eat or drink in areas of pesticide storage or use. Immediately after leaving a pesticide area, wash with soap and water.

11. Avoid climatic conditions that may cause off-site damage. Follow label recommendations for maximum wind velocities and time interval before rainfall.

12. Follow label requirements for time-to-harvest and field re-entry times.

13. Only treat target areas.

14. Comply to all Federal,State and local laws and regulations regarding pesticide notification and other worker safety issues.

15. Chemigation systems must be fitted with effective antisiphon devices or check valves to prevent backflow into water supplies.

VII. Support Date for Documentation:

A. Field Location

B. Acres

C. List pest(s) and control methods planned. For pesticides, list potential water quality problems. List matrices resultant potential and the interpretation.

VIII. Reference:

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INTERIM SOIL RATINGS FOR DETERMINING
WATER POLLUTION RISK FOR PESTICIDES
ERIE COUNTY, NEW YORK

MAP SYMBOL	COMPONENT NAME	SOIL-5 REC #	SOIL-6 TEXTURE	HYD GRP	LAYER DEPTH	ORG MAT	K FAC	WAT TAB DEPTH	SLOPE UPPER	SOIL LEACH POTENTIAL	SOIL SURFACE LOSS POTENT
AlA	ALLARD	NY0219	SIL	B	9	2 -7	1.49	>6.0	3	INTERMEDIATE	NOMINAL
AlB	ALLARD	NY0219	SIL	B	9	2 -7	1.49	>6.0	8	INTERMEDIATE	INTERMEDIATE
AmA	ALTON	NY0026	GRF-L	A	9	2 -5	1.17	>6.0	3	HIGH	NOMINAL
AmB	ALTON	NY0026	GRF-L	A	9	2 -5	1.17	>6.0	8	HIGH	NOMINAL
AmC	ALTON	NY0026	GRF-L	A	9	2 -5	1.17	>6.0	15	HIGH	NOMINAL
AnB	ALTON	NY0262	GR-L	A	8	2 -5	1.17	>6.0	8	HIGH	NOMINAL
AnC	ALTON	NY0262	GR-L	A	8	2 -5	1.17	>6.0	15	HIGH	NOMINAL
AoA	ANGOLA	NY0154	SIL	C	11	3 -6	1.37	0.5-1.5	3	NOMINAL &	NOMINAL
AoB	ANGOLA	NY0154	SIL	C	11	3 -6	1.37	0.5-1.5	8	NOMINAL &	INTERMEDIATE
ApA	APPLETON	NY0145	SIL	C	9	3 -6	1.32	0.5-1.5	3	NOMINAL &	NOMINAL
ApB	APPLETON	NY0145	SIL	C	9	3 -6	1.32	0.5-1.5	8	NOMINAL &	INTERMEDIATE
ArB	ARNPORT	NY0110	VFSL	B	4	1 -3	1.28	>6.0	8	INTERMEDIATE	INTERMEDIATE
ArC	ARNPORT	NY0110	VFSL	B	4	1 -3	1.28	>6.0	15	INTERMEDIATE	INTERMEDIATE
ArD	ARNPORT	NY0110	VFSL	B	4	1 -3	1.28	>6.0	25	INTERMEDIATE*	INTERMEDIATE
ArE	ARNPORT	NY0110	VFSL	B	4	1 -3	1.28	>6.0	40	INTERMEDIATE*	INTERMEDIATE
AuC	AURORA	NY0153	CN-SIL	C	9	2 -6	1.28	1.5-2.0	15	NOMINAL &	INTERMEDIATE
Be	BEACHES					-		-			
BfA	BENSON	VT0002	CNV-L	D	6	2 -6	1.20	>6.0	3	NOMINAL	NOMINAL
BfB	BENSON	VT0002	CNV-L	D	6	2 -6	1.20	>6.0	8	NOMINAL	INTERMEDIATE
BgC	BENSON	VT0002	CNV-L	D	6	2 -6	1.20	>6.0	15	NOMINAL	INTERMEDIATE
BhB	BENSON ROCK OUTCROP	VT0002	CNV-L	D	6	2 -6 -	1.20	>6.0 -	8	NOMINAL	INTERMEDIATE
BlA	BLASDELL	NY0088	CN-SIL	A	8	3 -6	1.28	>6.0	3	INTERMEDIATE	NOMINAL

I-5 Pesticide Data Base

Some pesticide properties have an obvious effect on water quality while others are more subtle. The pesticide data used in this document provides estimates of pesticide properties to determine relative risk to water resources. To estimate site-specific water quality risks, the effect of pesticide properties must be considered in relation to that site's characteristics, such as kind of soil, slope, depth to ground water, potential for runoff, and expected uses of the ground and surface water.

The pesticide properties data in this document was retrieved from the "USDA-ARS Interim Pesticide Properties Database, Version 1.0" by R. D. Wauchope, August 5, 1988. As these values are updated, they will be placed into the database and submitted to the state offices.

The data base has some limitations, which include:

1. The list of U.S. Environmental Protection Agency (EPA) approved active ingredients (abbreviated "ai") changes rapidly, as does the list of approved uses for each "ai." Field office staffs should not make pesticide use recommendations based on the pesticide data base. The data base only provides data for evaluating relative risks to water resources. Specific recommendations should be based on the latest information from the Extension Service and state regulatory agencies.

2. The estimates of risk to water resources in the data base or derived from the data base should not be considered precise—there are too many variables involved. The estimates of risk should be considered a first approximation and a guide for better management.

When the predictions of risk are *extremely safe, or extremely risky*, predictions may be used with confidence. For all intermediate predictions, judgment will be needed. If risk is relatively high and lower-risk pesticide options are available, the lower-risk options should be used. If lower-risk pesticide options are not available, the user should be advised on other alternatives such as tillage for weed control or crop rotations to reduce pests.

A description of each pesticide property in the data base follows. Pesticides are listed in alphabetical order by common name.

Common name

The common names are generic names. They refer to a chemical compound without naming a specific product. There are a few pesticides which do not have a common name. These are listed by trade name.

In some cases, one common name may be used for several chemically-related compounds. "2,4-D," for example, is available in the acetic acid form, the ester form, and soluble salt form. These three forms of 2,4-D have considerably different properties, so as pesticides, they are listed separately. Still, many people refer to all forms by the common name, "2,4-D."

U.S. trade name and manufacturers

Some pesticide compounds are formulated as trade name products for sale by only one manufacturer. Compounds that have outlived patent protection, however, may have several trade names. The limited list of trade names in the data base is from the Crop Protection Chemicals Reference and the BASF Company literature.

Other trade name products not in the data base will usually have the common name of the active ingredient on the label.

A specific EPA-registered product must have a defined "ai" at a defined concentration. Some companies, however, confuse things by using nearly the same trade name for two or more products containing entirely different active ingredients.

To further complicate the issue, state recommendations often avoid mentioning trade names.

So if a trade name is given by a user, more than one active ingredient may be involved. If a common name is given, many trade names, several different formulations, and possibly chemical derivatives may be involved. Whether a trade name or common name is used, planners must know what the active ingredients are, and at what concentration.

Use

The use listing is included for general information. It is not complete because of frequent changes in the registered uses and should not be followed as a recommendation. Most of this information was taken from labels.

Formulation type

Formulation is the physical form in which a product is packaged and is specific for a given product. For example, "D.Z.N. Diazinon 4E" is a product

of Ciba-Geigy which contains four pounds of diazinon per gallon and is a 47.5% diazinon solution. The diazinon is dissolved in a hydrocarbon solvent with surfactants, which allow the solution to be easily mixed with water to form an emulsion suitable for spraying.

Formulation type is important in predicting pesticide behavior. The long-term (weeks to months) life of a pesticide will be a function of its physical properties and persistence, but its initial life (hours to days) will be a function of its formulation. For example, about 30 times more wettable powders than emulsified concentrates will be lost if both are applied to soil surfaces and immediately subjected to rain.

Most formulation types are designed to be mixed with water and sprayed through nozzles. These formulations can be described as:

1. Wettable powders which are added to spray water and kept in suspension by agitation.

2. Aqueous concentrates which are water-based mixtures diluted with spray water.

3. Emulsifiable concentrates which form emulsions in the spray tank and are kept mixed by agitation.

4. Dispersible liquids which are suspensions of very fine pesticide particles in a thick liquid and thinned with spray water.

5. Dispersible granules which are powders formed into granules and break down on contact with water and form a suspension similar to wettable powders.

6. Soluble solutions are solutions of the "ai" in a solvent that is mixable with water.

7. Microcapsules which are tiny polymer spheres containing the "ai" and suspended in water.

8. Soluble powders which dissolve in water.

Formulations which are not designed to be mixed in water include granules and pellets which are applied by spreaders, and oil-based materials designed to be sprayed in various oils.

Application mode

The application mode is important in determining the primary location of the pesticide in the target area. The pesticide location determines the initial behavior. The importance of location is illustrated by comparing Trifuralin, a herbicide, and Carbaryl, an insecticide.

Trifuralin is typically applied as a spray to a bare soil surface and mixed in. It is volatile and will evaporate if left on the surface. Weeds are killed as they sprout in the soil.

Carbaryl, a wettable powder, is applied to vegetation such as apple trees for insect control and is easily washed off leaves by water.

Trifuralin is fairly persistent but is a low runoff risk because it is incorporated in soil. Carbaryl has a high runoff potential because it is a wettable powder applied to leaves. Carbaryl persistence, however, is short, as the active ingredients dissipate rapidly when exposed to sun and wind.

The application mode depends on the spray target, such as weed or crop plants, and whether it is applied to the soil surface or incorporated in the soil. Both runoff and persistence will be strongly affected by where the active ingredient ends its flight from nozzle. In many cases, the final location of the pesticide will be divided between soil, foliage, and air. Only the major deposition location is listed in the data base.

Solubility in water

The solubility of the pesticides in water at room temperature is given in ppm (mg/l). This is the solubility of the pure ai, not the formulated product. Solubility is a fundamental physical property of a chemical and will strongly effect the ease of washoff and leaching through soil. In general, pesticides with solubilities of 1 ppm or less will tend to stay at the soil surface and be washed off the field in the sediment phase of runoff. Thus practices designed to reduce erosion will also stop pesticide runoff. An "E" code means the solubility value given is an estimate and may be in error by up to a factor of three. A "G" code means literally that a guess estimate of the solubility has been made and the error may be one or two orders of magnitude.

Half-life in soil

Half-life, given in days, is the time required for pesticides in soils to be degraded so that their concentration decreases by one-half. Pesticide degradation can be fairly accurately described by assuming that each successive elapsed half-life will decrease the pesticide concentration by half, so, for example, a period of two half-lives will reduce a soil concentration to one-fourth of the initial amount. "Persistence times" often reported in the literature are the times required for a pesticide to degrade to the point that it is no longer active. We have arbitrarily assumed this equal to four half-lives when a persistence time was the only data available.

Half-lives vary by a factor of three or more depending on soil moisture, temperature, oxygen status, soil microbial population and other factors. The numbers given should only be used as relative indicators of persistence. "E" codes mean the value is estimated and is probably in error by a factor of two or more. "G" codes mean the estimate could be off by a factor of three or more.

These half-lives are for pesticides in the interior of the soil and generally refer to chemical or microbiological degradation. Pesticides deposited on the soil surface or deposited on leaf or crop litter surfaces, and remaining there because of an absence of rain, are also subject to evaporation and sunlight and generally show half-lives of only a few days or less.

Soil sorption index

The index for soil sorption is measured by the Koc value. The Koc measures the tendency of the pesticide to be strongly attached, by chemical or physical bonds, to soil particle surfaces. The higher Koc values (1000)have a stronger attachment to soil and a lesser tendency for the pesticide to move except with sediment movement. Conversely, the lower Koc values will tend to move with water and have a potential for deep percolation below the root zone or being carried in runoff water. The "E" code means a probable error of 3x - 5x and a "G" code means a probable error of 10x - 100x.

C. A. reference

The C.A. Reference is a number assigned by the Chemical Abstract Service of the American Chemical Society (ACS) to a specific chemical compound. When a new chemical is developed, it is described in an abstract and registered with the ACS. The society assigns a number to the compound to be used as a reference by the chemical profession.

Runoff potential

The runoff potential indicates the tendency of the pesticide to move with sediment in runoff. A large rating means the pesticide has a high tendency to move with sediment while a small rating means the pesticide has a low potential to move with sediment. The pesticide runoff potential rating should be used in conjunction with the Soil Pesticide Interaction Ratings, section II-1, to evaluate pesticide movement.

Leaching potential

The leaching potential indicates the tendency of a pesticide to move in solution with water and leach below the root zone into deep percolation. The ratings of large, medium, small, and total use describes the potential for leaching. A rating of large means the chemical has a high potential for leaching. The total use rating means the pesticide should not leach with the percolating water. The pesticide leaching potential should be used in conjunction with the Soil Pesticide Interaction Ratings in section II-1 to evaluate pesticide movement.

2,4-D ACID

Trade name(s): Dacamine (mixture with 2,4-D amine salt)
Manufacturer(s): Fermenta
Use: herbicide: lawns, orchards, grains, rice, corn, sorghum
Formulation type(s): aqueous solution
Application mode(s): target weed foliar spray
Solubility in water (mg/l): 890
Half life in soil(days): 10
Soil sorption index ('Koc'): 20
C.A. Reference: 94-75-7
Surface loss potential: SMALL
Leaching potential: MEDIUM

2,4-D ESTER OR OIL-SOLUBLE AMINE

Trade name(s): Aqua Kleen, Weedone, Emulsamine
Manufacturer(s): Fermenta, Rhone-Poulenc
Use: herbicide: aquatic weeds, grains, corn, sorghum, sugarcane, noncropland
Formulation type(s): granules, emulsifiable concentrate
Application mode(s): granules applied to water surface; weed foliar spray
Solubility in water (mg/l): 50 E
Half life in soil(days): 10
Soil sorption index ('Koc'): 1000 E
C.A. Reference: 1928-38-7
Surface loss potential: MEDIUM
Leaching potential: SMALL

2,4-D SOLUBLE AMINE SALT

Trade name(s): Weedar
Manufacturer(s): Rhone-Poulenc
Use: herbicide: lawns, noncroplands, grains, corn, rice, sugarcane, pasture, orchards, vegetables, sorghum
Formulation type(s): aqueous solution
Application mode(s): target weed foliar spray
Solubility in water (mg/l): 300000
Half life in soil (days): 10
Soil sorption index ('Koc'): 109
C.A. Reference: 94-82-6
Surface loss potential: MEDIUM
Leaching potential: MEDIUM

2,4-DB ESTER

Trade name(s): Butyrac Ester
Manufacturer(s): Rhone-Poulenc
Use: herbicide: alfalfa, birdsfoot trefoil
Formulation type(s): emulsifiable concentrate
Application mode(s): target weed foliar spray
Solubility in water (mg/l): 50 E
Half life in soil(days): 10 E
Soil sorption index ('Koc'): 1000 E
C.A. Reference: 94-82-6
Surface loss potential: MEDIUM
Leaching potential: SMALL

2,4-DB SOLUBLE SODIUM OR AMINE SALT

Trade name(s): Butyrac, Rascue (mixture with naptalam soluble salt)
Manufacturer(s): Rhone-Poulenc, Union Carbide
Use: herbicide: peanuts, soybeans, alfalfa, clover, forage legumes
Formulation type(s): concentrated aqueous solutions
Application mode(s): seedling weed foliar spray
Solubility in water (mg/l): 200000
Half life in soil(days): 10 E
Soil sorption index ('Koc'): 20 E
C.A. Reference: 94-82-6
Surface loss potential: SMALL
Leaching potential: MEDIUM

3-CPA SOLUBLE SODIUM SALT

Trade name(s): Fruitone CPA
Manufacturer(s): Rhone-Poulenc
Use: growth regulator: pineapple
Formulation type(s): aqueous solution
Application mode(s): crop plant spray
Solubility in water (mg/l): 200000
Half life in soil(days): 10 E
Soil sorption index ('Koc'): 20 E
C.A. Reference:
Surface loss potential: SMALL
Leaching potential: MEDIUM

A selection of fields and records from the USDA-ARS, *Interim Pesticide Properties Data Base*, Version 1.0, by R.D. Wauchope. Surface loss and Leaching potentials by Soil Conservation Service.
E=Estimate value; probable error is 2X to 3X for Half life, and 3X to 5X for Solubility and 'Koc'
G= Guess value; probable error is 5X for Half life, and 1 to 2 orders of magnitude for Solubilities and 'Koc'

II-1 Soil-Pesticide Interaction Ratings

Introduction

Soil-pesticide interaction ratings help determine the potential for pesticide loss from surface runoff and from leaching or percolation below the root zone when a specific pesticide is used on a specific soil.

Soil and pesticide ranking

Soils are ranked according to potential for pesticide loss from surface runoff and from leaching. Soils ranking tables are available to the states from the same location as the SOILS-5 data at Ames, Iowa. The state staff should get these tables from Iowa and distribute to the field offices only those soils ranking tables that are pertinent to each individual field office. The tables list the soil series, surface loss potential, and leaching potential. The soil surface loss potential and soil leaching potential are ranked as **high, intermediate, or nominal.**

Pesticides are ranked according to potential for loss to surface runoff and leaching. The pesticide ranking tables are in section I-5, Pesticide Data Base. In this section there is a list of pesticide properties that include the surface loss potential and leaching potential for each pesticide. The surface loss potential is ranked as **large, medium, or small.** The leaching potential is ranked as **large, medium, small, or total use.**

Which procedure to use:

The field office staff should determine the water resource concern (e.g. ground water or surface water quality), then select the appropriate procedure. The respective procedure determines the potential loss of a pesticide when used on a particular soil.

Procedure

Both the pesticide rank and the soil rank are used to determine the potential for pesticide loss into surface runoff or to leaching. Follow these steps:

Potential Pesticides Loss to Leaching:

1. Find the leaching potential for the soil series from the soil ranking tables.
2. Determine the pesticide leaching Potential from the Pesticide Properties in Section I-5, Pesticide Data Base.
3. Use these ratings with the *Potential pesticide loss to leaching matrix* (fig. 1) to determine potential 1-3.

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Using the Matrix: The intersection of the soil leaching potential and the pesticide leaching potential gives the overall leaching potential-- a potential 1, 2, or 3. For example, the shaded "Potential 3" area below was from a soil with intermediate soil leaching potential and a pesticide with a small leaching potential.

Figure 1. *Potential pesticide loss to leaching matrix*

Soil leaching potential	Pesticide leaching potential			
	Large	Medium	Small	Total use
High	Potential 1	Potential 1	Potential 2	Potential 3
Intermediate	Potential 1	Potential 2	Potential 3	Potential 3
Nominal	Potential 2	Potential 3	Potential 3	Potential 3

Surface runoff:

1. Find the soil surface loss potential for the soil series from the soil ranking tables. If the soil mapping unit has a slope equal or less than 2%, reduce the soil surface loss potential by one unit, i.e. intermediate to nominal.

2. Determine the pesticide surface loss potential from the Pesticide Properties in Section I-5, Pesticide Data Base.

3. Use these ratings with the *Potential pesticide loss to surface runoff matrix* (fig. 2) to determine Potential 1-3.

Figure 2. *Potential pesticide loss to surface runoff matrix*

Soil surface loss potential	Pesticide surface loss potential		
	Large	Medium	Small
High	Potential 1	Potential 1	Potential 2
Intermediate	Potential 1	Potential 2	Potential 3
Nominal	Potential 2	Potential 3	Potential 3

General Considerations: The introduction of the "Pesticide Data Base", I-5-1 to I-5-5 should be read and understood. The method of application should be considered. Keep in mind that: (1) Foliar applications can result in only a small portion of a pesticide reaching the soil surface where it can be subject to loss. (2) Pesticides applied in a band below the surface or incorporated into the soil may have a lower loss to surface runoff but a higher loss to leaching than estimated by this technique. Take this into consideration when these methods of application are used. Consult locally developed guidelines or the manufacturer.

The pesticide data base lists the solubility in water, half-life in soil, and soil sorption index. These factors were used in estimating the surface loss and

leaching potential of the pesticide. Some of the factors may have an 'E' (estimated value) or 'G' (guess value). If an updated estimate of the pesticide surface loss or leaching potential is available from the manufacturer or other sources, use it.

The probability of rainfall soon after pesticide application should be considered in most climates. The loss estimates used in this procedure assume considerable precipitation immediately after application. If little or no precipitation occurs, a significant loss may not occur. Considerations in this area depend largely on the half-life of the pesticide. After the elapse of one half-life, one-half of the original pesticide concentration has been degraded, thus one-half remains. A pesticide with a half-life of 4 days will be at 25% of original concentration in 8 days (two half-life periods). Thus, if a rainfall event is not expected for a time equal or greater to three times the half-life of the pesticide, little pesticide loss would be expected.

The following guidelines are provided for use of Potentials 1, 2, and 3:

Potential 1: This pesticide applied on this soil has a high probability of being lost to surface runoff or leaching. Before deciding to use Potential 1 pesticides, they should be evaluated for their health hazard to humans and animals. If a pesticide is a potential danger to health, an alternative pesticide, or other pest management techniques should be selected. Carefully evaluate the factors listed in the "General Considerations" section and the additional considerations as follows:

Determine the sensitivity of the surface water resource. Ask such questions as: Is the water used for drinking or recreation? Where is the field located in relation to the water resource?

If a herbicide is being used consider vegetation adjacent to the application area. Will surface loss affect the vegetation? Will aquatic vegetation be affected if a pond or lake will receive surface runoff from the area?

If ground water is a concern, questions might include: what is the health risk? What is the depth to the aquifer? Where is the nearest well withdrawal? What is the rate of water leaching from soil into the aquifer?

If the pesticide poses a potential problem to a water resource, the land user should consider such items as: (1) alternative pesticides, (2) alternative pesticide application techniques, (3) biological control such as insect attractant traps, and (4) crop management techniques such as rotations.

Potential 2: Potential 2 is a gray area. This pesticide applied on this soil has the possibility of being lost to surface runoff or leaching. However the possibility of loss is not as great as Potential 1. The effect of the pesticide on the water resource will need additional site evaluation. Refer to the guidelines for Potential 1.

Potential 2 guidelines differ from Potential 1 in: (1) the pesticide surface loss potential may be reduced one rank, i.e., large to medium, if foliar applied, incorporated, or banded under the surface, (2) the pesticide leaching

potential could be reduced one rank if foliar applied, and (3) the use of this pesticide on this soil could be considered similar to potential 3 if the rainfall probability is low.

Potential 3: This pesticide applied on this soil has very low probability of being lost to surface runoff or leaching. This pesticide could be used according to label with little hazard to the respective water resource.

Revised October 1988

II-3 Soil Rating for Nitrate and Soluble Nutrients

Introduction

This section provides a way to determine the degree to which water percolates below the rootzone in certain soils. Percolating water containing dissolved nitrates or other soluble nutrients could be a hazard to ground water. The method is based on a Leaching Index (LI)[1].

For areas with ground water concerns, the LI should be determined to evaluate the potential for contaminating the ground water with soluble nutrients. The LI uses annual precipitation, hydrologic soil group, and rainfall distribution data.

Leaching index

A LI map for each hydrologic soil group was developed for each state and is being provided during the Water Quality workshops. The hydrologic group describes those soils that do not have dual hydrologic ratings because of differences in drainage. Soils with hydrologic rating such as A/D should be evaluated on the basis of the current drainage status. If the soil has a high LI and is over a shallow aquifer, soluble nutrients-- especially nitrates-- may contaminate the water.

The LI does not account for irrigation. If irrigation is applied only to supply plant needs, there will be little additional loss below the rootzone. The additional loss would be relative to the precipitation events after the soil profile is saturated or nearly saturated due to irrigation.

In areas of marginal water quality, the amount of irrigation water applied includes a leaching fraction to insure that salts do not build up in the soil. If a leaching fraction is applied, this amount of water must be added to the LI. For example, if the leaching fraction is 1.2 and irrigation is applied to make up a 4 inch soil-water deficit, a 4.8 inch (1.2 x 4.0 in) irrigation would be applied. The LI should be increased by 0.8 inches. The same calculation must be made for each irrigation.

Procedure

Follow these steps to determine the leaching index of a certain soil:
1. Find the soil's hydrologic group.
2. Locate the iso-leaching map for that group..
3. From the map, based on the soil location, determine the LI.

[1]The method to calculate the Leaching Index was developed by J R Williams and D E Kissel in "Water Percolation An Indicator of N Leaching Potential", from *Managing Nitrogen For Groundwater Quality and Farm Profitability*, Edited by R F.Follet (Unpublished).

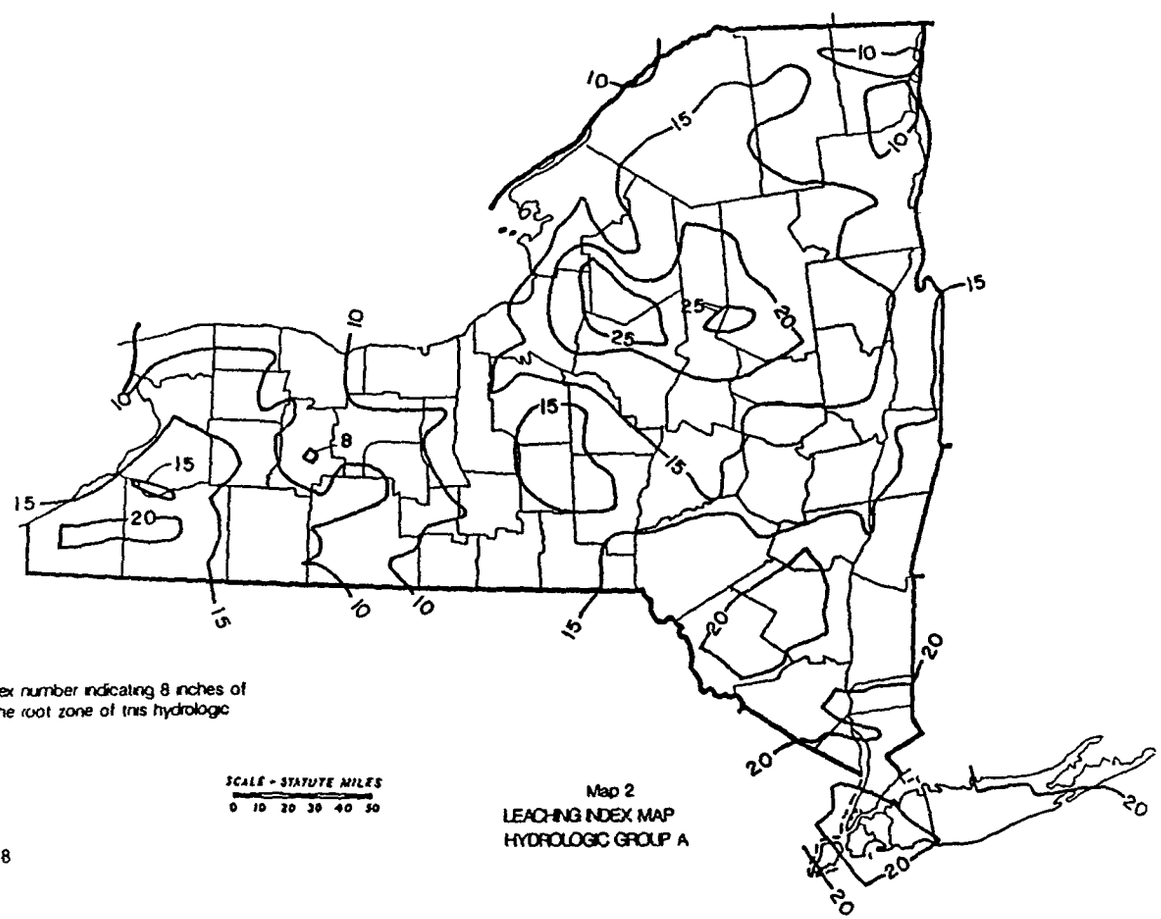
Guidelines for recommendations:

A LI below 2 inches would probably not contribute to soluble nutrient leaching below the rootzone.

A LI between 2 and 10 inches may contribute to soluble nutrient leaching below the rootzone and nutrient management should be considered.

A LI larger than 10 inches will contribute to soluble nutrient leaching below the rootzone. Nutrient management practices should be intense or soluble nutrients should not be applied. Also, consider using conservation practices that minimize infiltration, such as strip cropping rather than pipe outlet terraces.

LEACHING INDEX FOR HYDROLOGIC GROUP A
NEW YORK



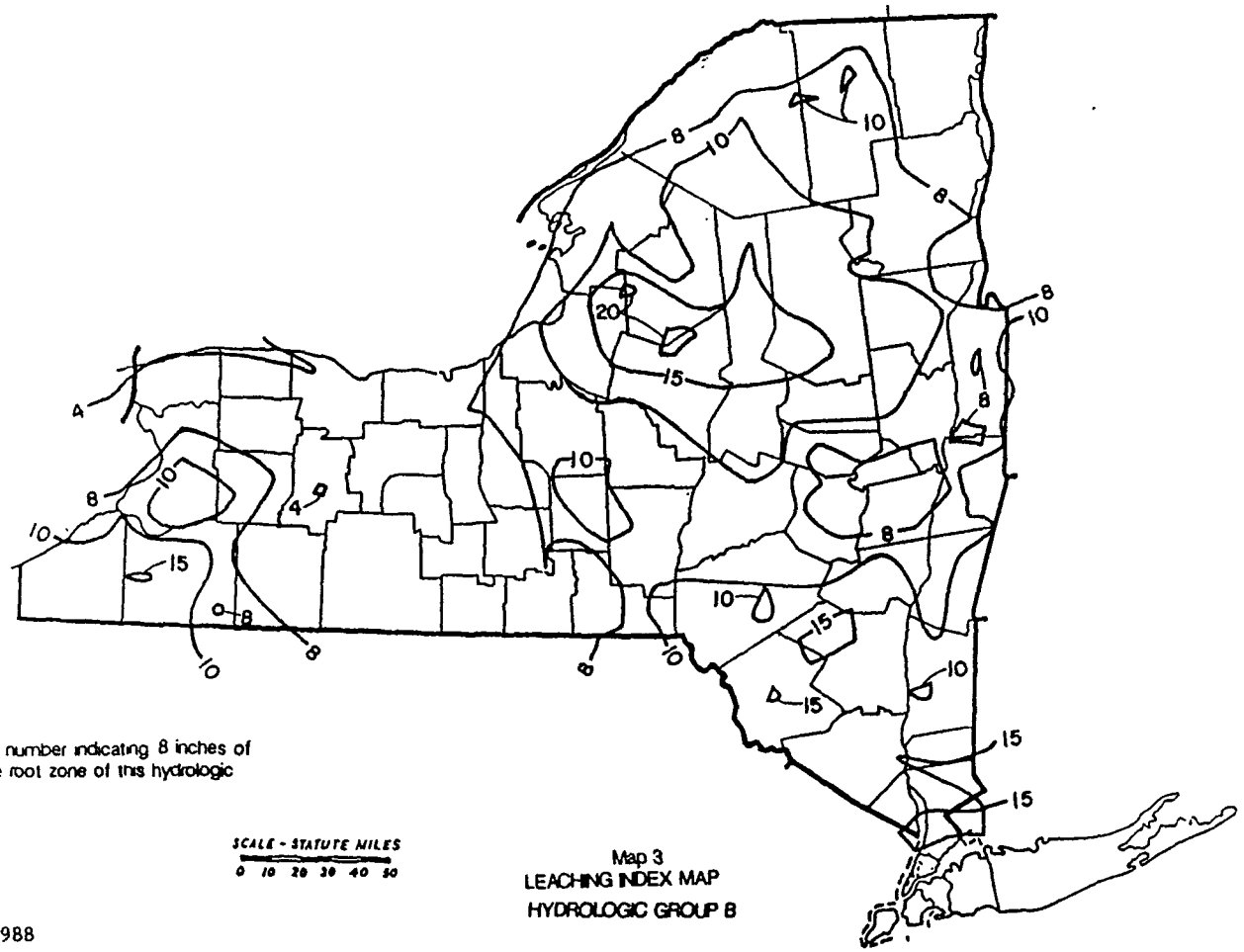
) Leaching (Li) index number indicating 8 inches of leaching below the root zone of this hydrologic soil group

SCALE - STATUTE MILES
0 10 20 30 40 50

Map 2
LEACHING INDEX MAP
HYDROLOGIC GROUP A

December 1988

LEACHING INDEX FOR HYDROLOGIC GROUP B
NEW YORK

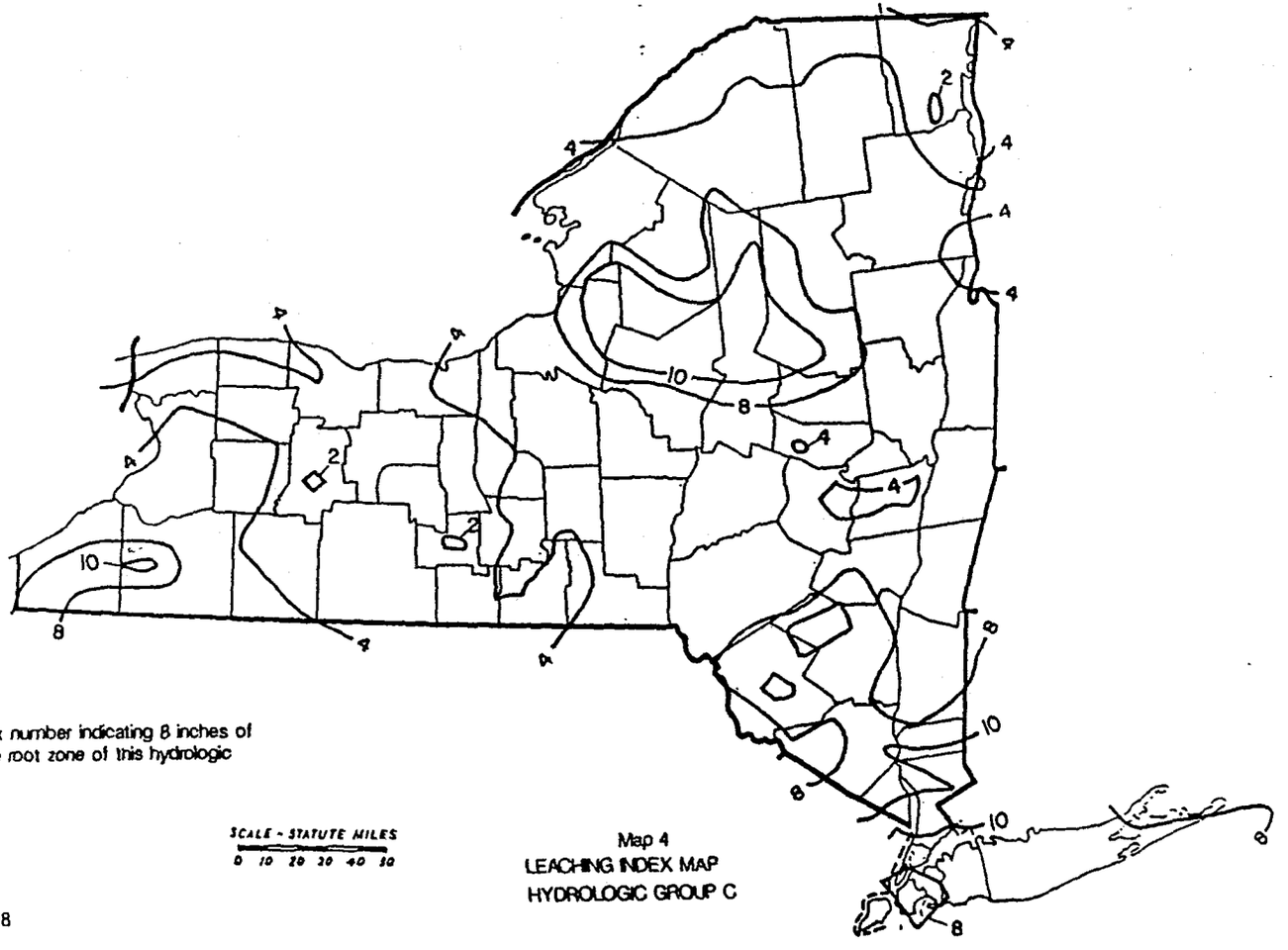


(9) Leaching (Li) index number indicating 8 inches of leaching below the root zone of this hydrologic soil group

Map 3
LEACHING INDEX MAP
HYDROLOGIC GROUP B

December 1988

LEACHING INDEX FOR HYDROLOGIC GROUP C
NEW YORK



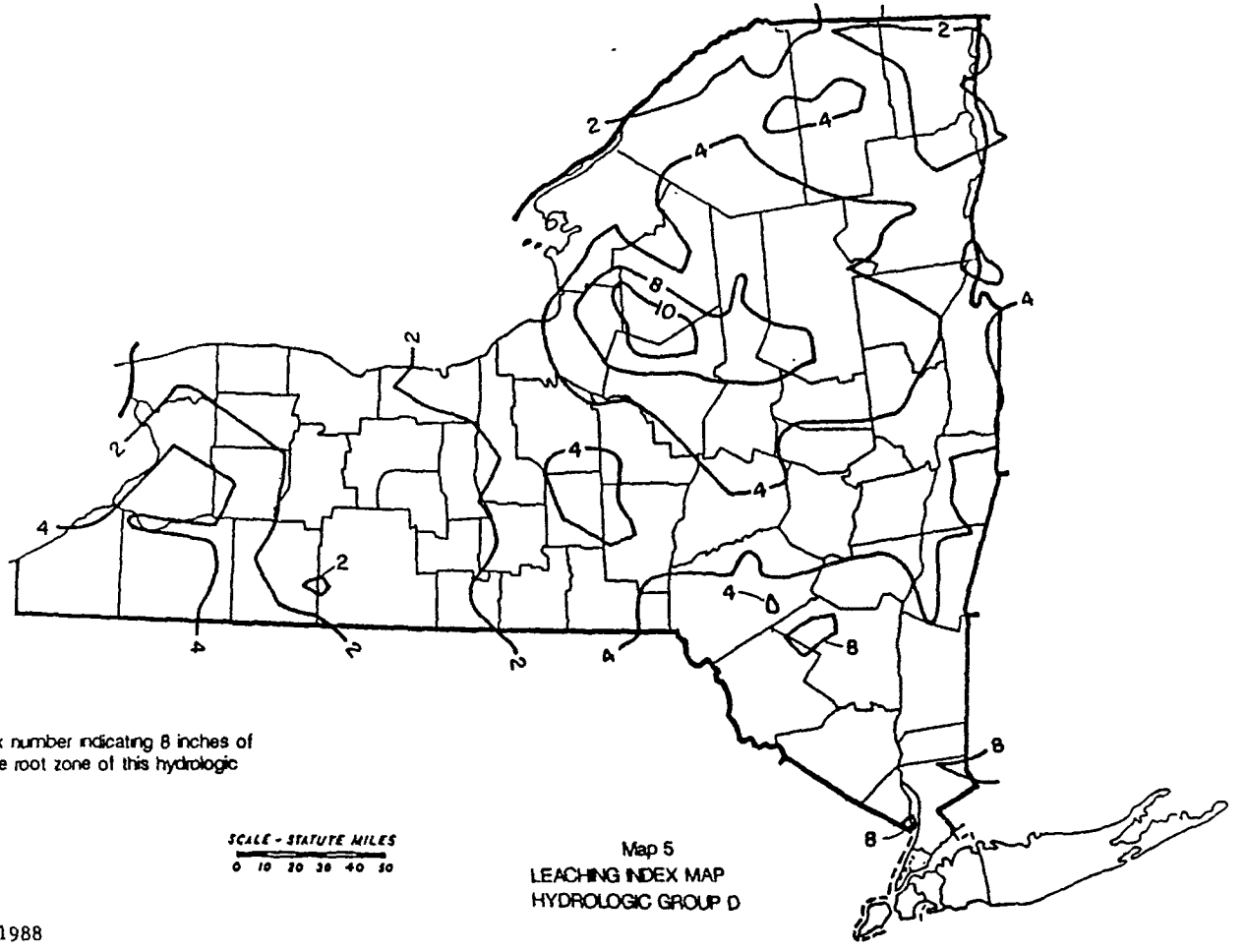
(8) Leaching (Li) index number indicating 8 inches of leaching below the root zone of this hydrologic soil group

SCALE - STATUTE MILES
0 10 20 30 40 50

Map 4
LEACHING INDEX MAP
HYDROLOGIC GROUP C

December 1988

LEACHING INDEX FOR HYDROLOGIC GROUP D
NEW YORK



(8) Leaching (Li) index number indicating 8 inches of leaching below the root zone of this hydrologic soil group

SCALE - STATUTE MILES
0 10 20 30 40 50

Map 5
LEACHING INDEX MAP
HYDROLOGIC GROUP D

December 1988

3.3.5 North Carolina

NUTRIENT MANAGEMENT (ACRE)

I. DEFINITION: Managing the amount, source, form, placement, and timing of applications of plant nutrients, especially nitrogen and phosphorus, which are of primary concern for water quality protection.

II. PURPOSE: Managing a soil fertility program consistent with realistic production goals that also minimizes the entry of nutrients to surface and ground water. Includes managing all sources of plant nutrients such as organic wastes, commercial fertilizers, soil reserves, and crop residue.

III. CONDITIONS WHERE PRACTICE APPLIES: On all lands where plant nutrients are applied.

IV. PLANNING CONSIDERATIONS:

A. Effect on Water Quality—This practice would reduce the likelihood that applied nutrients would pollute surface or ground water by limiting the amount applied to only that needed for realistic crop yields normally obtained on benchmark soils under good management and weather conditions. Evaluate the vulnerability of environmentally sensitive areas and water supplies.

B. All sources and forms of plant nutrients being made available for plant growth and production shall be considered in developing a nutrient management plan. Develop a nutrient budget for the proposed crop by utilizing the soil and waste recommendations from Agronomic Division of N.C.D.A. report forms.

C. The nutrient management program should be based upon current NCDA and NCSU recommendations utilizing the results of soil and waste test. Considering the available nutrients, develop acceptable and reasonable crop yield goals, hereafter referred to as "realistic yield goals."

D. Erosion control and water management practices should be included to minimize soil loss transport and runoff which may carry attached dissolved nutrients to surface waters. This is of particular importance where soils contain high levels of phosphorous.

E. Fertilizer source, time, and method of application should be manipulated to conform to seasonal variation in plant uptake needs and soil profile properties to minimize nutrient loss by leaching or transport.

Nitrogen and phosphorous are the most critical nutrients in planning for water quality.

F. Soil pH affects the availability of nutrients. Plan to adjust soil pH to the level best suited for the crops being grown.

G. Development and maintenance of good soil tilth may enhance plant nutrient uptake efficiency, thereby minimizing the need for applied fertilizer to compensate for poor root development.

H. Cover crops can be used to take up excess plant nutrients to prevent their movement out the root zone. Where waste applications are used in fall and winter, cover crops should be used for nutrient uptake.

I. Organic wastes can provide an important source of nutrients. State and local regulations, the National Agriculture Waste Management Field Manual, NCSU Crop Production Guides and the NCSU Agricultural Chemical Manual, soil test and waste analysis reports will provide guidance concerning waste utilization.

J. Plant tissue samples should be taken to evaluate fertilizer status and to support the need for additional nutrient applications.

V. SPECIFICATIONS GUIDE:

A. SOURCES: Sources of plant nutrients may include residual amounts in the soil, crop residues, waste products, and commercial fertilizer. Commercial fertilizers are those products with a guaranteed analysis under North Carolina laws.

All animal waste products shall be tested by the agronomic division of NCDA or other acceptable laboratories and the recommendations used to develop and implement a nutrient management plan. On-farm generated wastes should be sampled annually for nutrient content and after any change in management practices that might influence the nutrient content of the waste.

B. RATES: Nutrient application rates on agricultural land should be based on soil test and waste analysis, consistent with the NCDA or NCSU recommendations. When soil test and waste analysis are not available, follow recommendations in the NCSU crop production guides. These should be based on realistic crop yield expectations and should consider all sources of nutrients that may be available as outlined in the attached nutrient budget worksheet.

1. Choose a fertilization rate within recommended ranges of soil test recommendations that takes into account local water quality needs. Unrealistic yield expectations often encourage excessive nutrient applications resulting in unnecessary production costs and an increased hazard for water quality degradation. Utilize information regarding the inherent productivity of the predominant soils in the field or management unit along with historic yield information as a starting point.

2. Frequency of Soils Tests: Soil samples should be tested before each crop and shall be tested no less than once every two years.

C. APPLICATION METHOD AND TIMING: Important considerations for nutrient application includes source, placement, and timing. Plant nutrients may be applied as broadcast, starter, surface band or injected band applications. Any one method may have its advantages under a given set of plant nutrients demands, soil characteristics, and fertilizer source.

Commercial nitrogen for a spring-planted crop will not be applied in late fall or winter. Waste nutrients shall not be applied in fall or winter for spring planted crops on soils with a high potential for leaching unless special precautions are taken to minimize leaching and erosion. Waste nutrient loading rates (of waste) on these soils should be held to a minimum and winter cover crops planted to absorb nutrients released. Buffer strips should be established around site.

1. Nitrogen - Loss of nitrogen from the soil is dependent upon climate, soil, and application program. Normally, with adequate soil moisture, nitrogen loss potential can be reduced by applying nitrogen fertilizer close to the time of greatest crop demand. Split applications may be needed. Of the various forms of nitrogen, nitrate is most subject to leaching losses.

   Use Section II-O, Nitrogen loss potential for N. C. Soils, along with soils information for the field, to identify the potential hazard for nitrogen loss.

   Soil properties greatly influence leaching potential. Principal factors include the sandiness of texture and thickness of course surface horizons, as well as the internal drainage class of the soil.

   General Guidelines

   Where high leaching hazard exists, and where appropriate for the crop in question, nitrogen use efficiency and environmental safety can be enhanced by using fertilizers low in NO_3 form in combination with split applications.

   Also, the use of nitrification inhibitors with NH_4 forming fertilizers can reduce the risk of nitrogen loss through leaching and denitrification under some conditions.

   On soils of intermediate leaching potential, split and side dress nitrogen applications are highly recommended for best efficiency. There are not significant concerns for the use of NO_3 sources or the need for nitrification inhibitors on these soils.

   For soils with nominal leaching potentials, fall application of N for summer crops will be permitted with special precautions, i.e., adequate soil loss prevention, BMP's, etc.

Section II-O demonstrates the comparative leaching potential of soils of North Carolina. These examples provide the guidelines for assessing NO_3 leaching risk and recommended management programs.

2. Placing nutrients in contact with the soil generally reduces the chance of runoff and loss. An effective erosion program will reduce the potential for surface water pollution from transported nutrients.

   When soil test levels are high, no additional amounts of these nutrients will be applied unless a row applied starter fertilizer is suggested. Also, levels of nutrients other than nitrogen can be exceeded with adequate soil loss prevention measures. Application rates for nitrogen shall not be exceded.

3. Plant available nutrient content of animal wastes shall be considered and the waste will be injected or incorporated immediately after application. If nitrogen utilization is not an objective and surface runoff control measures such as heavy residue cover, contour farming, contour stripcropping or terraces have been applied or surface runoff will not contribute to a water quality problem, surface application is acceptable. A waste utilization plan will be prepared.

D. pH: Crops perform best within a specific range of soil pH. Soil tests shall be used to determine liming needs.

E. EQUIPMENT OPERATION AND MAINTENANCE: Equipment shall be calibrated to apply recommended rates on the field. Special precautions must be taken to avoid well contamination when using fertigation.

   Equipment should be cleaned after nutrient application. Waste water resulting from flushing application equipment should be kept away from wells, streams, ponds, lakes, or other water bodies and out of high runoff areas. Return to supplier or store excess material in an appropriate manner. Follow all state and local regulations concerning storage of materials and disposal of product containers.

F. SAFETY: Avoid unnecessary exposure to hazardous chemical fertilizer and organic wastes. Protective clothing, including goggles, a respirator, gloves and footwear should be worn when handling potentially dangerous materials.

G. DISPOSAL: Dispose of product containers in accord with local and/or state regulations. Follow all local, state, and federal regulations regarding the transport of fertilizers. In case of an accidental fertilizer spill, call 1-800-662-7956 (NC Hazardous Material Notification Office) for disposal instructions and handling.

VI. DOCUMENTATION DURING PLANNING

Those items marked with an asterisk will be recorded as minimum documentation requirements.

* 1. Location
* 2. Extent in acres
* 3. Nutrient balance sheet
4. Source of nutrients
* 5. Nutrient timing and placement
6. Soil erosion control
7. Equipment operation and maintenance
8. Safety
* 9. Receiving water body (NRCD-DEM Stream Classification index number)

VII. REFERENCES:

North Carolina State University Crop Production Guides

NCDA Crop Fertilization Based on Soil Test

Soil Test Reports and Recommendations

NCSU Agricultural Chemical Manual

USDA-SCS Soils Data Base. Soils ratings for determining water pollution risk for pesticides for the state of North Carolina.

Waste Analysis Reports and Recommendations

Plant Analysis Reports and Recommendations

NRCD - DEM Stream Classification Index

NUTRIENT BUDGET WORKSHEET

Prepared by: _____ County: _____

Field No: _____ No. Acres: _____ Date: _____

Soil Series: _____ Leaching Potential: _____

Tillage Practices: _____

Previous crop: _____ Yield: _____

Planned crop: _____ Yield expectations: _____

Soil Test Levels: P-I _____; K-I _____; pH _____

Organic Waste-Nutrient Content: _____ N/Ton _____ P_2O_5/Ton _____ K_2O/Ton
or lbs. per 1,000 gallons

Available N: _____*

		N	P_2O_5	K_2O
A.	Soil Test Recommendation	_____	_____	_____
B.	Organic Waste			
	1. Rate to be applied _____ (Tons/Ac.) or _____ lbs. per 1,000 gallons			
	2. Waste contribution	_____	_____	_____
C.	Legume Residue N Credit	_____	_____	_____
D.	Nutrient Needs or Surplus	_____	_____	_____
	$D = A - B_2 - C$			

* Refer to Livestock Manure Production Rates and Nutrient Content on Pp 308-311, 1989 North Carolina Agricultural Chemicals Manual for nutrient loss for surface applied and incorporated animal waste.

PESTICIDE MANAGEMENT (ACRE)

I. DEFINITION: Managing the type, amount, placement, and timing of application of pesticides needed for crop production.

II. PURPOSE: To control target organisms and minimize contamination of soil, water, air, and nontarget organisms through safe and prudent use of pesticides.

III. CONDITIONS WHERE PRACTICE APPLIES: On all lands and water where chemical pest control is needed to augment other means of control.

IV. PLANNING CONSIDERATIONS:

A. Effect on Water Quality—This practice is designed to protect surface and ground water quality by managing pesticide applications to only those necessary to protect the agricultural commodity.

B. Encourage the use of Integrated Pest Management (IPM) systems that utilize the most appropriate means of pest management including cultural, biological, and chemical methods.

C. Use field scouting, nematode assay, and economic thresholds (where available) to determine when and if pesticides should be used in an Integrated Pest Management program. Treatment thresholds for specific pests and crops are available from the North Carolina Agricultural Extension Service and NCDA. Avoid unnecessary and poorly timed application of pesticides.

D. Base pesticide selection on characteristics such as water solubility, toxicity to non-target organisms, degradation, adsorption, efficacy, and cost as well as site characteristics such as soil, geology, water infiltration, depth to water table, proximity to surface water, topography and climate. Select pesticides that the potential for pesticide pollution of surface and ground water is minimized and the crop is adequately protected.

E. Plan erosion control practices to minimize soil loss and runoff that can carry adsorbed or dissolved pesticides to surface waters.

F. Follow currently recommended pesticide use programs which consider the possibility of reducing the potential for pesticide resistance and shifts in the pest spectrum.

G. Encourage persons using pesticides to:

1. Read and follow all label directions. Keep Material Safety Data Sheets accessible.

2. Handle and apply pesticides properly to protect the user and the environment from adverse effects. All pesticide users should be encouraged to take the Private Pesticide Applicator's Training offered by the NC Agricultural Extension Service. This training provides pesticide users with information on how to handle and apply pesticides in a safe and efficient manner. Any person planning to purchase and use pesticides classified as "restricted use" is required to take this training and be certified by the North Carolina Department of Agriculture.

3. Pesticides used in chemigation shall be labeled for this method of application. All chemigation systems must be fitted with effective antisiphon devices to prevent backflow into water supplies and comply with other requirements of Rule 2 NCAC 9L .2000 - Chemigation, as adopted by the N. C. Pesticide Board.

4. All incidents of accidental release of pesticides that may cause adverse effects on the environment shall be reported to the Emergency Management Division, N. C. Department of Crime Control & Public Safety. Statewide 24 hour emergency number is 1-800-662-7956, or call Raleigh 733-3867.

5. Store pesticides according to label directions and as specified by local, state, and federal regulations.

6. Follow product label directions as well as local, state, and federal regulations regarding posting and field re-entry restrictions on treated areas.

7. Persons using pesticides shall avoid exposure by wearing appropriate clothing as specified by product label and local, state, and federal regulations. Know what to do in case of accidental pesticide exposure.

8. Prevent contaminating water supplies by keeping the filler hose or pipe out of the spray tank at all times when adding water to a spray mixture. For added protection, install a backflow prevention device. Never leave a spray tank unattended while it is filling to avoid overflow. Locate all pesticide preparation areas and storage and supply tanks at least 150 feet away from and downslope from any water well.

9. Dispose of pesticide wastes and pesticide containers according to label directions and local, state, and federal regulation. Never reuse pesticide containers for any purpose. Contact the Pesticide Disposal Program at NCDA for more information (919) 733-7366.

10. Calibrate equipment before mixing and loading pesticides. Calibrate equipment at the beginning of and periodically during each season. Since nozzle wear increases application rate and can alter spray patterns, calibration rates should be checked during the spray season.

11. Avoid spray drift by applying pesticides only when wind speeds do not exceed label directions or local, state, or federal regulations.

12. Triple rinse pesticide containers and add rinsate to spray solution. Clean application equipment after each use and apply rinsate to a labeled site according to label directions.

13. Assure that the pesticide applicator knows the exact location of the area to be treated and the potential hazard of spray drift or subsequent pesticide movement onto surrounding areas.

V. SPECIFICATIONS GUIDE:

Pesticide selection will be made based on its suitability to control the target pests, impact on the non-target organism, and the environment. The following pesticide evaluation procedure outlined below shall be used.

A. Potential Loss to Leaching.

1. Find the leaching potential for the soil series from Section II-O of the Field Office Technical Guide.

2. Determine the pesticide leaching potential from Table 1 as supplemented by the N. C. Agricultural Chemical Manual and the N. C. Agricultural Extension Service Crop Production Guide. If the pesticide will be applied postemergence and directed primarily to the foilage, reduce the potential for leaching by one class.

3. Use the following matrix to determine a potential rating of 1, 2, or 3.

TABLE 1

POTENTIAL PESTICIDE LOSS TO LEACHING

Soil Leaching Potential	Pesticide Leaching Potential			
	Large	Medium	Small	Very Small
High	Potential-1	Potential-1	Potential-2	Potential-3
Intermediate	Potential-1	Potential-2	Potential-3	Potential-3
Nominal	Potential-2	Potential-3	Potential-3	Potential-3

4. Potential Ratings:

   a. Potential 1 — The pesticide applied on this soil has a high probability of being lost through leaching. An alternate pesticide with lower loss potential or alternative pest management techniques will be considered.

   b. Potential 2 — The pesticide applied on this soil has a possibility of being lost through leaching. Additional onsite evaluation is necessary to determine the sensitivity of the water resource and the type of water resource of concern. When a potential water resource problem exists, the landuser will consider (1) Alternate pesticides; (2) reduction in pesticide rate and/or area covered (for example - band application); (3) To cultural control methods; or (4) Biological control methods.

   c. Potential 3 — This pesticide applied on this soil has a very low probability of being lost to leaching.

B. Potential Loss to Surface Runoff.

1. Find the soil surface loss potential for the field soil series from Section II-O of the Field Office Technical Guide. If a soil mapping unit has a slope of 2 percent or less, reduce the soil surface loss potential by one class. If the soil mapping unit has a slope of 10 percent or more, increase the soil surface loss potential by one class.

2. Determine the pesticide surface loss potential from the Pesticide Properties found in Section I of the Field Office Technical Guide as supplemented by the N. C. Agricultural Chemical Handbook and NCAES Crop Production Guides. If the pesticide will be applied postemergence onto a full canopy, reduce the potential for surface runoff by one class.

3. Use the following matrix to determine a potential rating of 1, 2, or 3.

TABLE 2

POTENTIAL PESTICIDE LOSS TO SURFACE RUNOFF

Soil Surface Loss Potential	PESTICIDE SURFACE LOSS POTENTIAL		
	Large	Medium	Small
High	Potential-1	Potential-1	Potential-2
Intermediate	Potential-1	Potential-2	Potential-3
Nominal	Potential-2	Potential-3	Potential-3

C. Potential Ratings:

1. Potential 1 — This pesticide applied on this soil has a high probability of being lost through surface runoff. An alternate pesticide with lower loss potential or alternative pest management techniques shall be considered. Adequate levels of erosion control are essential to minimize risk of surface water contamination.

2. Potential 2 — This pesticide applied on this soil has a possibility of being lost through surface runoff. Additional onsite evaluation is necessary to determine the sensitivity of the water resource and the type of water resource of concern. When a potential water resource problem exists, the landuser will consider (1) Alternate pesticides; (2) reduction in pesticide rate and/or area covered; (3) cultural control methods; or (4) Biological control methods. Adequate levels of erosion control must be maintained.

3. Potential 3 — This pesticide applied on this soil has a very low probability of being lost to surface runoff.

D. Read and follow all label instructions.

E. Follow all local, state, and federal regulations in the selection, use, storage, and disposal of pesticides.

VI. DOCUMENTATION DURING PLANNING

Those items marked with an asterisk shall be recorded as minimum documentation requirements.

*1. Location
*2. Extent in acres
3. Integrated Pest Management Techniques
*4. Pest management control strategies
*5. Environmental assessment when chemical controls will be used in an identified sensitive area.
6. Soil erosion control
7. Equipment operation and maintenance
8. Safety
*9. Receiving water body (NRCD-DEM Stream Classification index number)

VII. REFERENCES:

Current year, North Carolina Agricultural Chemicals Manual, N. C. State University.

Current NCSU Crop Production Guides

NRCD - DEM Stream Classification Index

3.4 EDUCATION AND TRAINING NEEDS

To fully integrate and implement the use of nutrient and pest management standards and specifications at the field office level, a comprehensive interdisciplinary education and training effort is needed. In the process of developing the prototype standards and specifications some of these needs have become apparent. Following is a brief discussion of these needs.

The education and training program will involve three phases. This is due to the fact that there is a wide disparity in the knowledge levels of state and field office personnel about nutrient and pest management. This statement is true for both SCS and ES. In addition, the same disparity exists in state agency personnel, including soil and water conservation district technicians and personnel with designated water quality agencies.

The first phase of the education should involve a general familiarization of the staffs with the respective materials, manuals and specialists available to discuss the current standards and specifications. This type of training can resonably be accomplished over a 1- to 2-day period.

In the second phase, each of the standards and specifications should be discussed in enough detail so that the individuals can have questions answered. The data used in development of the standards should be presented and discussed. At a minimum, this phase requires a week of education for both nutrient and pesticide management. This training will need to be provided on a continuing basis, if not every year, at least every other year to keep field office staff abreast with current developments. After the initial session, this may be accomplished by yearly updates which are conducted during 1- to 2-day sessions.

Where it is desired that the staff be educated to a level of competence that will allow them to make recommendations, a third phase is required. This will require that selected staff be given the opportunity to enroll in advanced college level courses or equivalent on soil fertility and pesticide management.

The Cooperative Extension Service (CES) should evaluate the need and prepare a plan for the development of this type of course or courses that will be available for any interested individuals.

All of the required expertise to provide the desired level of training and education will not be available within CES or SCS. This will require that the respective state offices of SCS and CES look outside their organizations for the required expertise. Persons and materials available in other states with similar problems and concerns should be used. A joint plan for a phased education program should be developed between SCS and CES at the

state level to indicate the needs and availability of staff expertise and materials.

As materials are developed whether they are publications, computer software, video tapes, etc., attention should be paid to provide materials in a form that can be used by other states with similar conditions, so they need not be duplicated. An example where this type of approach would be helpful is in the karst region of Minnesota, Wisconsin, Iowa and Illinois. Educational materials addressing nutrient and pesticide management in this area could be used by all four states.

CES has established regional educational coordinating committees on water quality. These committees can be a vehicle to provide these materials.

To implement at the field office level, the use of nutrient and pesticide standards and specifications will require a significant education effort and commitment. It will need to evolve over a 3- to 5-year period.

3.4.1 Necessary Skills for Field Office Personnel

Both ES and SCS have conducted or are conducting assessments of training needs. In the ES assessment process, several points have been raised which are relevant for consideration by both ES and SCS.

As outlined above, the type of training needed depends to a great degree on the amount of previous experience and training. There is a spectrum of training needs within both agencies.

From the water quality perspective, there is a need for technical competence and the availability of sound technical information. Development of these standards and specifications allows the opportunity to summarize and organize the technical information. Field staff can then make use of the information in their land manager's contacts.

Information provided must be technically correct and readily available. Part of the necessary training should be about where the information is and where it can be found. Development of the standards and specifications allows the referencing of additional back-up materials.

Both extension agents and district conservationists need training on how to work with multiple organizations, conflict resolution, and futuring. In water quality matters, it is everybody's business, so field staff need to be prepared to deal with a wide variety of people and organizations.

3.4.2 Who Should Participate in Training?

Since solutions to water quality problems associated with nutrient and pest management can only be addressed by multidisciplinary teams. Personnel from a number of state and federal agencies should be involved.

Participants should include not only SCS, ES, ASCS, SWCDs and state water quality agencies, but also local politicians, local farm managers, and crop consultants.

3.4.3 Implications for Training

It is important that both ES and SCS field staff receive clear direction from the respective state offices that this training and subsequent cooperation should be accomplished.

The training should be conducted by individuals with both technical expertise and teaching ability. It should not matter what agency they come from.

Since there will need to be different levels of instruction, it will be important to accurately describe the level at which the training will take place. This way the field staffs can make a decision about choosing training at the appropriate level.

There is a significant need to provide training on how to categorize, manage, and retrieve information.

Agency networking, coordination and role definition needs to be addressed in the training and education context. At all levels decisions need to be made on who will do which tasks. These decisions need to be reinforced and supported.

3.5 NUTRIENT AND PEST MANAGEMENT RESEARCH NEEDS

During the development of the nutrient and pest management standards and specifications, a number of areas where additional research is needed have been indicated. Following is a list of those needs identified during this project.

This is not meant to be a comprehensive list of research needs. The list is indicative of the major questions and areas of need that surfaced during the conduct of this project.

3.5.1 Nitrogen Research Needs

A number of concerns in regard to nitrogen management needs to be addressed by additional research under a variety of soil, crop, and climatic conditions. Research topics are as follows:

1. Research the use of soil tests to predict and reflect the amount of nitrogen that is available for plant uptake from residual nitrogen, including that left from commercial fertilizer, legumes in the rotation, and the utilization of organic waste materials. This test should also reflect nitrogen available from mineralization of soil organic matter.

2. Use of the soil tests should be researched in conjunction with split applications for a variety of nitrogen sources. Split-applications should be evaluated for their environmental effects as well. On sandy soils and some well-drained silt loams, this technique can be effective in reducing leaching from the root zone. However, there is a lot that needs to be learned about where and under what conditions this will be an effective practice.

3. From a soil sampling standpoint, research needs to be conducted on the optimum time and depth of sampling. This is especially true under conservation tillage systems and where legumes are in the rotation and manure is used. Attention should be paid to sample result turnaround times and handling of samples.

4. Evaluate the impact of nitrification inhibitors have on increasing plant uptake efficiency and reduction in leaching.

5. Investigate the utilization of green manure crops to reduce nitrogen leaching and in more arid areas, use of alfalfa as a scavenger crop for nitrogen. For instance, in the Upper-Midwest, green manure crops do not appear to be viable at this time; while further south there are some options available. This area should have additional attention.

6. Application of nitrogen fertilizer should be made on the basis of individual soil properties. Research should be conducted on application equipment that allows changing rates within fields. This means "farming by kind of soil".

7. The effectiveness of various soil conservation practices and soil resource management systems should be evaluated on the efficiency of nitrogen use and the quantities leached. This will have to take place under a variety of soil, crop, and climatic conditions.

8. Research the nitrogen content of different livestock manures and subsequent plant availability.

9. Research the impact of tile drainage systems on movement of nitrogen from fields for different resource management systems.

10. Research crop quality relative to increased efficiency and reduced loss.

3.5.2 Phosphorus Research Needs

Following are the items of concern raised by the project on research on phosphorus use and management.

1. Soil test procedures, sample depths, location, and handling to predict available under different resource management systems.

2. Characterize phosphorus availability from the use of animal and other organic waste. At what rates and under what soil and climatic conditions is phosphorus a problem for groundwater.

3. The impacts of leaching phosphorus on the contributions to phosphorus losses to surface water.

4. Evaluate resource management systems in their ability to reduce phosphorus inputs into surface and groundwater.

5. Evaluate the relationship between phosphorus management and crop productivity in a variety of crops, climate, and soil characteristics.

6. Evaluate the mobility of phosphorus from animal waste sources relative to commercial sources.

7. Encourage and research "farm by kind of soil" techniques.

3.5.3 Pest Management Research Needs

A number of research needs from the pest management standpoint were indicated by this project.

1. There is a large lack of data available on the quantification of movement of pesticides and their metabolites by surface and groundwater.

2. Research is necessary on cultural weed control to provide an understanding of where the crop damage thresholds lie in terms of weed pressure.

3. Research should be conducted on the fate and movement of individual pesticides or classes of pesticides under crop and resource management systems.

4. How do management, amount and method of application, soil, climate, and plot characteristics affect movement of

pesticides in the environment?

5. Research should be conducted on toxicity of pesticides in surface water environments. This should be done on a variety of organisms from micro to macro.

6. Research should be conducted on the effectiveness of Integrated Pest Management techniques to reduce pesticide movement to surface or groundwater.

7. Degradation of pesticides in groundwater aquifers needs to be investigated. Does degradation and/or adsorption continue? What are the aquifer characteristics that control this?

8. Research should be conducted on biological controls to minimize or eliminate the need for pesticide use.

9. Continued research is necessary on the synergistic effects of a combination of pesticides in drinking water on human health.

10. Evaluate the effect of conservation tillage systems and residue management on the movement of pesticides on groundwater.

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NEW YORK STANDARD-DRAFT **DRAFT**

USDA-SCS, New York
FOTG
~~January 31~~ July, 1989

PRACTICE NAME: Nutrient Management

UNIT OF PRACTICE: Acres

PRACTICE CODE: to be assigned

I. DEFINITION: Managing the amount, source, form, placement and timing of applications of plant nutrients such as nitrogen, phosphorous, potassium, and other elements needed for plant growth and crop production.

II. SCOPE: This standard gives guidelines for managing plant nutrients. Sources of plant nutrients include inorganic fertilizers, soil reserves, crop residues, manures, and high-nutrient organic wastes. Procedures for handling manures and organic wastes are also given in the SCS Waste Management Standard. The nutrient management standard does not include using or disposing of hazardous waste.

III. PURPOSE: To supply adequate plant nutrients for optimum crop yield, minimize entry of nutrients to surface and ground water, maintain or improve the chemical, physical and biological condition of the soil, and to employ safe handling practices.

IV. CONDITIONS WHERE PRACTICE APPLIES: On all lands where plant nutrients are applied.

V. PLANNING CONSIDERATIONS

A. Effect on Water Quality. This practice reduces the potential for pollution of surface or ground water by nutrients through balancing the quantity of plant-available nutrients with that needed to produce an optimum crop yield; and through management practices that limit nutrient movement to surface or ground water.

B. General Management Considerations

1. Development of a nutrient budget for the proposed crop considering
   - plant-available soil nutrient levels,
   - nutrient needs for the crop by using realistic yield goals for given soil type and climatic conditions,
   - nutrient additions, and
   - nutrient uptake efficiency,

   as implemented through the Cornell Soil Test System recommendations.

2. Insurance of proper placement and uniform application. This may include broadcast or band applications.

3. Manipulate timing, placement and method of application of nutrients such as to minimize the potential for contamination of surface or groundwater. This may include split applications, nutrient incorporation, and the use of manure or waste spreading schedules.

4. Optimize nutrient uptake and plant growth through
   - proper seedbed preparation and planting
   - timely planting and harvest
   - maintenance or development of an optimum plant growth environment through water management (drainage and/or irrigation), prevention and/or alleviation of soil compaction, maintenance of optimum soil pH, maintenance of optimum (not excessive) levels of other soil nutrients, and adequate pest control.

5. Conservation tillage, sod-based crop rotations, sod waterways, contour farming and contour strip cropping are the most cost effective ways to reduce surface loss of nutrients. Control of surface losses of nitrogen may increase subsurface leaching.

6. Avoid the use of slow-release nitrogen fertilizers, which may result in excess soil nitrogen levels after the growing season. The use of non-nitrate based fertilizers may reduce the potential for nitrogen leaching.

C. Environmental Considerations.

1. Soils

a. Consider soil-nutrient interactions when specifying nutrient management practices. The potential for leaching of nitrogen to groundwater is greater in permeable soils, especially those with shallow water tables. Phosphorus, nitrogen and wastes are susceptible to surface loss on soils with high surface loss potential (not yet defined).

b. Avoid excessive irrigation in soils where nutrient leaching is of concern, especially for shallow rooted crops. Avoid excessive surface runoff through soil and water conservation practices on soils where nutrient surface loss is of concern.

c. Plan nutrient applications when the soil water status is at field capacity or dryer to minimize surface loss and leaching.

2. Climate

Avoid surface-applied nutrient additions on frozen or snow-covered soils or before high-intensity rainfall, especially when the soil is saturated, to prevent surface loss.

VI. SPECIFICATIONS

A. Nutrient Management Practices

1. Nutrient Testing

a. Determine the cropping and tillage sequence. Specify the number of years for each crop in the rotation and identify cover and green manure crops, and the legume percentage of recent pasture and hay sod. Describe the crop residue use as specified in the appropriate SCS standard. Otherwise, define what is adequate.

b. Determine the soil series and map unit symbol, depth of tillage, drainage modification, and manure or waste spreading schedule.

c. If nutrient additions are planned, soil and/or plant tissue testing should be performed as specified in the grower's guide (Cornell Recommends) through
   - collection of representative samples
   - submission of samples to the Cornell Nutrient Analysis Laboratory (or other laboratories that employ Cornell nutrient recommendations), with inclusion of the requested field and crop information.

d. Follow the fertilizer recommendations provided with the nutrient test results for timing, placement and quantities. Use fertilizers that do not cause crop injury or otherwise adversely affect plant growth.

2. Soil-Fertilizer Interactions

a. Determine the potential loss of nitrate due to leaching:

Determine the soil hydrologic group from the SOILS-5 data base.

Find the Leaching Index (LI) from the Leaching Index Maps for each soil mapping component, as described in the Soil Rating for Nitrate and Soluble Nutrients in the FOTG.

A LI below 2 inches indicates that the potential for soluble nutrient leaching below the root zone is low.

A LI between 2 and 10 inches indicates that the potential for soluble nutrient leaching below the root zone is intermediate. Additional site evaluations are in order. Practices specified under LI's greater than 10 inches should be considered.

A LI greater than 10 inches indicates that the potential for soluble nutrient leaching below the root zone is large. The following practices shall be implemented to reduce the potential for nitrate leaching to groundwater.

- Strict timing of application of nitrogen in accordance with plant uptake needs. On crops that receive more than 50 lbs of N per acre per year, split applications are to be employed. Total preplant applications of nitrogen are permissible with the use of nitrification inhibitors. Fall nitrogen applications are not permitted. Waste and manure spreading schedules must be developed, as specified in the

Waste Utilization Standard (to be updated) and Cornell Field Crops and Soils Handbook.

- Consideration of management practices such as cover crops to take up excess nutrients and prevent their movement out of the root zone.

- Avoidance of nitrate leaching from excessive irrigation through proper irrigation scheduling practices.

b. (Tentative)

Determine the potential for loss of nutrients due to surface runoff:

Find the surface loss potential for each soil mapping component from the Soil Ratings for Nutrient Surface Loss in the FOTG (to be developed).

If the soil mapping component has a slope equal or less than 2%, reduce the soil surface loss potential by one unit, i.e. INTERMEDIATE to NOMINAL.

A NOMINAL potential indicates that surface loss of nutrients is not a major concern.

If the potential is INTERMEDIATE, a possibility exists for nutrient loss through surface runoff. Additional site evaluations are in order. Practices specified under HIGH potentials should be considered.

If the potential is HIGH, a high probability exists for nutrient loss through surface runoff. The following practices shall be implemented to avoid nutrient loss:

- Planning of soil and water conservation practices to control erosion and runoff.

- Implementation of manure and waste management practices as specified in the Waste Utilization Standard (to be updated) and Cornell Field Crops and Soils Handbook.

- Injection or immediate incorporation of surface-applied fertilizers, manures and wastes.

- Avoidance of irrigation rates that exceed infiltration rates and induce surface runoff.

B. Operations, Safety and Maintenance

Nutrient applicators must:

Calculate and carefully measure the required quantity of nutrients to be applied.

Insure proper calibration of application equipment.

Maintain application equipment in proper working condition.

If nutrients require dilution with water, insure prevention of backsiphoning to water supplies,

Fit effective anti-siphon devices or check valves on fertigation systems to prevent backflow into water supplies.

Avoid unnecessary exposure to chemical fertilizer. Wear protective clothing when appropriate

When cleaning equipment after nutrient application, remove and save fertilizer in appropriate manner. If system is flushed, be sure waste water is kept away from high runoff areas, ponds, lakes, streams and other water bodies.

Destroy or dispose of fertilizer containers in an appropriate manner.

VII. SUPPORT DATA FOR DOCUMENTATION

Field location

Acres

Potential water quality problems -

- leaching potential (LI greater than 10)
- surface loss (HIGH potential)

Final nutrient plan

VII. REFERENCES

Cornell Recommends for all commodities

Cornell Field Crops and Soils Handbook

Irrigation Reference (to be developed)

Extension publications on nutrients and nutrient movement.

DRAFT

Pest Management
Unit of Practice: Acres
Practice Code: 514

Definition: Managing pests for optimum crop production and minimal degradation of the environment.

Scope: This standard gives guidelines for managing pests on all lands used for crop production. Non-agricultural and indoor pest management is excluded.

Purpose: To control target organisms and minimize contamination of soil, water, air and non-target organisms through safe and prudent pest management and an estimation of site specific water quality risks.

Conditions Where Practice Applies: On all lands used for crop production where pest management is needed.

Planning Considerations:

A. Effect On Water Quality

This practice reduces the potential of pesticides becoming pollutants of surface and ground water through:

1. Reduction of the total applied quantity of a given pesticide, if possible.

2. Use of proper application rates.

3. Targeted pest control.

4. Use of cultural and biological practices that substitute for or complement pesticide use.

5. Selection of pesticides with consideration of environmental implications.

B. General Management Considerations

1. Use crop and soil management practices that provide for vigorous plant growth. Healthy plants generally have higher tolerance to pests. Optimize nutrient uptake and plant growth through:

a. appropriate seedbed preparation and planting
b. maintenance or development of an optimum plant growth environment through:

- water management (surface and subsurface drainage and/or irrigation),
- avoidance or mitigation of soil compaction,
- maintenance of optimum soil pH levels,
- maintenance of optimum soil nutrient levels.

2. Apply the principles of Integrated Pest Management (IPM) including:

- Evaluation of the options for chemical, biological, and/or cultural pest control methods.

- Basing treatment on threshold populations (if known) as established through:

a. Field monitoring,
b. Field and crop history, or
c. Forecasting methods

- Optimization of timing of crop planting and harvesting.

3. Manipulate timing, placement and method of pest control such as to minimize the potential for negative environmental impact while maintaining satisfactory pest control.

C. Environmental Considerations

1. Soils

a. Consider soil and water conservation practices that reduce movement of pesticides off target sites. This includes

practices that reduce the loss of chemicals in solution, suspension or adsorbed to the soil particles, and filter strips to intercept overland flow. Control of surface losses of pesticides may increase subsurface leaching.

b. Consider soil/pesticide interaction when selecting a pesticide.

2. Climate

a. Avoid pesticide application when weather conditions are adverse for proper placement. This includes spraying under windy conditions, surface application before high intensity rainfall and application on saturated soil. Consult the label.

b. For volatile pesticides, avoid application under high temperature conditions. Consult the label.

c. Consider pesticide efficacy on pests as affected by temperature and/or moisture conditions. Pests under dormant or stressed conditions may be less susceptible to pesticide treatment.

d. For soil fumigants, avoid application under saturated and/or cold soil conditions. Consult the label.

e. Avoid application of wettable powders when soil and weather conditions allow for removal by wind.

3. Non-target organisms

a. Some pesticides are highly toxic to non-target organisms and contact with vulnerable organisms must be avoided , if possible. Consult the label.

b. Insure knowledge of local and/or state regulations on endangered or threatened species and adjust pesticide selection accordingly.

4. Potential Pest Resistance

Consider avoidance of continuous use of pesticides of similar chemistry to reduce the potential for pest resistance.

D. Pesticide Laws And Regulations

Pesticide applicators must abide by Federal and State laws and regulations.

Specifications:

A. Soil and Crop Management

The use of appropriate soil and crop management practices decreases the potential for crop damage from pests. Growers' Guides (Cornell Recommends), Cornell Field Crops and Soils Handbook, and Cornell Cooperative Extension Fact Sheets and Bulletins shall be used as guidelines for soil and crop management.

B. Integrated Pest Management (IPM)

IPM is the optimum approach to effective, economical and environmentally responsible pest management. A good IPM program helps the decision maker consider the costs, risks and benefits associated with a given course of action. These actions may include chemical, cultural and/or biological control methods.

The adoption of IPM practices shall be considered as appropriate.

C. Environmental Considerations for Selection of Pesticides

If chemical pest control is selected, use the appropriate Grower's Guides (Cornell Recommends) or the current New York State Pesticide Recommendations as published by Cornell Cooperative Extension.

When providing a grower with a Cornell University pesticide recommendation, include a disclaimer statement reading, "Every effort has been made to provide correct, complete, and up-to-date pesticide recommendations. Nevertheless, changes in pesticide regulations occur constantly and human errors are still possible. These recommendations are not a substitute for

pesticide labeling. Please read the label before applying any pesticide."

If appropriate, use adjuvants to increase pesticide efficacy and to keep the pesticide on the target pest.

To estimate site specific water quality risk, the chemical and physical properties of a pesticide must be considered in relation to soil and topographic characteristics.

1. Utilize the Field Office Technical Guide (FOTG) Soils Ratings to determine the soil's potential for leaching and surface runoff.

2. Subsequently, use the FOTG Pesticide Data Base to determine the pesticide potential for leaching and surface runoff.

3. Utilize the matrices in the Soil-Pesticide Interaction Ratings to determine the potential for pesticide loss to leaching and surface runoff.

4. Follow the guidelines for interpreting the potential pesticide loss ratings.

D. Operations, Safety and Maintenance

1. Pesticide users must operate according to the guidelines in the New York Pesticide Applicator Training Manual(s).

2. Application equipment shall be maintained in proper condition.

3. Load and mix pesticides at least 100 feet away from wells, high runoff areas, ponds, lakes, streams, and other water bodies.

4. The required quantity of pesticide will be calculated and carefully measured to avoid leftover tank mixes. If pesticides require dilution with water, insure prevention of back siphoning to water supply.

5. Calibrate equipment before loading and mixing pesticides. Calibrate equipment at the beginning of each season and each time one changes pesticides or application rates, or when appropriate.

6. Avoid climatic conditions that may cause off-site damage. Follow label recommendations for maximum wind velocities and time interval before rainfall.

7. Comply with all Federal,State and local laws and regulations regarding pesticide notification and other worker safety issues.

8. Chemigation systems (application of pesticides through an irrigation system) must be fitted with effective antisiphon devices or check valves to prevent backflow into water supplies.

Support Data for Documentation:

A. Field location or number

B. Acres

C. List cropland soils and their potential ratings for leaching and surface runoff.

References:

Cornell Cooperative Extension. Current year New York State Pesticide Recommendations. Cornell University, Ithaca, NY.

Cornell Cooperative Extension. Cornell Field Crops and Soils Handbook. 168 pp. Rev. 10/1987.

Cornell Cooperative Extension. Current Cornell Recommends for:

- Pest Control for Commercial Production and Maintenance of Trees and Shrubs.
- Commercial Turfgrass Management.
- Commercial Vegetable Production.
- Small Fruit Production.
- Commercial Tree-Fruit Production.
- Field Crops.
- Commercial Potato Production.

Endangered and Threatened Wildlife and Plants. 50 CFR 17.11 and 17.12. USF&WS Wash. DC.1/89.

Waldron, J. K. Status of IPM Methodology in Dairy/Field Crops. Cooperative Extension Service, IPM Committee, Cornell Univ., Ithaca, NY. 1/1988.

Kovach, J. Status of IPM Methodology in Fruit. Cooperative Extension, IPM Committee, Cornell Univ., Ithaca, NY. 1/1988.

Petzold, C. Status of IPM Methodology in Vegetables. Cooperative Extension, IPM Committee, Cornell Univ., Ithaca, NY. 1/1988.

Ferrentino, G. Status of IPM Methodology in Floriculture and Ornamental Horticulture. Cooperative Extension, IPM Committee, Cornell Univ., Ithaca, NY. 1/1988.

NY Pesticide Applicator Training Manuals - Core Manual plus Category and Subcategory Manuals.