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Modeling Agricultural Nonpoint Source Pollution for Economic Evaluation of the Conestoga Headwaters RCWP Project

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ABSTRACT

The CREAMS (Chemicals, Runoff, and Erosion from Agricultural Management Systems) model was used to evaluate soil and nutrient losses for typical field situations in Lancaster County, Pennsylvania. A wide range of field scenarios was modeled as part of the economic evaluation of the RCWP (Rural Clean Water Program) project. Best management practices (BMPs) reduced surface losses of nutrients. Reducing the amount of nitrogen applied to the field was the only effective method for reducing percolate losses of nitrates. Stored manure provides more plant-available nitrogen than does daily-spread manure.

Keywords: Agricultural nonpoint pollution, CREAMS, Rural Clean Water Program, modeling, manure.

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CONTENTS

PREFACE

The U.S. Congress enacted the Rural Clean Water Program (RCWP) in 1979 as an experimental program to combat agricultural nonpoint source pollution. RCWP, a voluntary program, provides long-term financial and technical assistance to owners of privately held agricultural land in selected project areas to install and maintain best management practices (BMPs) to control water pollution. The Agricultural Stabilization and Conservation Service (ASCS), U.S. Department of Agriculture (USDA), operates the program with technical assistance provided by other USDA agencies and the U.S. Environmental Protection Agency (EPA). The Soil Conservation Service (SCS), USDA, coordinates all technical services.

The Conestoga Headwaters RCWP project (Lancaster County, Pennsylvania) was selected for comprehensive monitoring and evaluation (CM&E). The CM&E consists of monitoring and evaluating the physical and the economic effects of the RCWP project. The Economic Research Service (ERS), USDA, is cooperating with the U.S. Geological Survey, the Pennsylvania Department of Environmental Resources, ASCS, and SCS in conducting the economic evaluation.

The economic evaluation includes evaluating RCWP effects on participants and local agriculture, evaluating offsite and community impacts, analyzing cost effectiveness, and comparing the project's benefits and costs. This report presents the physical measures of BMP effectiveness used for economic evaluation of the Conestoga Headwaters RCWP project. This report provides a limited economic interpretation of cost-effectiveness. A subsequent economic evaluation report will provide an indepth economic evaluation of the Conestoga Headwaters RCWP project.

SUMMARY

A field scale model for Chemicals, Runoff, and Erosion from Agricultural Management Systems (CREAMS) was used to evaluate soil, nutrient, and herbicide losses as part of the economic evaluation of the Conestoga Headwaters Rural Clean Water Program (RCWP) project. The CREAMS model was run for typical field situations and management practices in the project area. The output from CREAMS is reported along with an economic interpretation of the data.

CREAMS is comprised of three submodels: hydrology, erosion, and chemistry. The hydrology component estimates runoff volume and peak rate, evapotranspiration, soil water content, percolation, and infiltration. The erosion component gives the user estimates of erosion and sediment yield, including the particle distribution, at the field edge. The chemistry component allows the user to estimate field-scale stormloads and average concentrations of surface and percolate fractions of chemical losses. Chemicals considered with CREAMS included nitrogen (N), phosphorus (P), and pesticides (herbicides and insecticides).

A wide range of field scenarios was modeled with CREAMS. Soil erosion estimatess ranged from 28 tons per acre to less than 0.1 ton per acre, depending upon cropping pattern, field slope, and management practices. Similarly estimated total N and P losses ranged from 243 pounds per acre to 8 pounds per acre and 89 pounds per acre to 0.3 pound per acre, respectively. Best management practices (BMPs) used to control erosion were generally effective at restricting surface losses of N and P, but were relatively ineffective at controlling percolate losses of nitrate-nitrogen (NO_3-N). The most effective method of reducing losses in deep percolate was to reduce the amount of nutrients applied to the crop. Storage and proper application of manure were effective practices for reducing nutrient losses at recommended loading rates (20 tons per acre or less); however, total N losses increased with storage at high application rates.

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INTRODUCTION

Nonpoint source pollution finds a pathway to streams through both surface and subsurface flows. A method was needed to estimate both components of pollution. A systems approach is needed to evaluate the effectiveness of individual or combined best management practices (BMPs) for preventing water-quality degradation. For example, decreasing runoff and increasing infiltration without nutrient management may actually increase N losses for the whole system.

Estimates of nonpoint source pollution were needed as part of the economic evaluation of the Conestoga Headwaters Rural Clean Water Program (RCWP) project in Lancaster County, Pennsylvania. Estimates of the relative effectiveness of BMPs for controlling losses of stream pollutants were needed. A modeling approach was an inexpensive means of determining the relative effects of individual BMPs as well as combinations. Cost-effective combinations of management practices were identified when estimates of pollution were integrated with BMP cost data.

The CREAMS model was used to evaluate the effectiveness of management practices for the Conestoga Headwaters RCWP project. This report presents results of this modeling activity and discusses the economic implications of the CREAMS results.

THE CREAMS SIMULATION MODEL

Description of the Model

A field scale model for Chemicals, Runoff, and Erosion from Agricultural Management Systems (CREAMS)[1] is a mathematical model that assesses nonpoint source pollution at the field scale, and compares the effectiveness of management practices for conservation. This model, built in response to the water-quality legislation of the seventies, was designed to minimize the calibration necessary for its application. CREAMS allows continuous simulation to estimate runoff,

1/ Model documentation and the user's manual for CREAMS can be found in (3). For a description of the application of CREAMS to Pennsylvania agriculture and the sources of input parameter estimates, see (2). A description of key modeling assumptions is presented in appendix A.

NOTE: Underscored numbers in parentheses refer to items in the list of references.

erosion, and transport of chemicals in solution and attached to sediment at the field scale.

The CREAMS option chosen in this study considers overland-flow losses of runoff, erosion, and the chemicals they carry, and NO_3 lost in deep percolate. Surface losses were estimated when delivered to the edge of the field, and losses of NO_3 were given as leached out of the root zone. No delivery assumptions were made for surface or percolate losses to receiving water. The sediment delivery ratio in the Conestoga watershed from sediment source to live streams was estimated as 0.2 (7). This could represent the approximate delivery ratio of sediment-associated nutrients and pesticides to streams. Chemicals in the solution phase (dissolved in runoff) would have a significantly higher delivery ratio than those that were sediment-associated (for further discussion, see appendix A). CREAMS was used to evaluate the effectiveness of alternative BMPs for preventing field losses of pollutants, not for determining stream quality. Version 1.5 of the model was used.[2]

CREAMS was used to evaluate losses of pollutants and the relative effectiveness of practices to control pollution. Modeling is no substitute for monitoring, and losses for one practice should be compared with those of another practice in relative terms. No pretense is made that the losses portrayed in the CREAMS results accurately measured absolute losses. CREAMS was not designed for estimating actual losses, and no attempt was made to calibrate the model to monitoring data in Pennsylvania. No monitoring data existed, nor was it being collected for individual BMPs. Several situations modeled with CREAMS were new and unique applications of the model. If readers recognize and understand the limits of modeling, they can gain insight into BMP effectiveness for controlling nonpoint source pollution.

Hydrology Component

Rainfall data for the model can be either daily or, if available, breakpoint. Breakpoint data is time-intensity data, and allows infiltration to be calculated in the model at histogram breakpoints. The data used were collected at 5-minute intervals to the nearest tenth of an inch. Three years of rainfall data, representing dry, normal, and wet years, were collected from Agricultural Research Service rain gauge RE-37, located approximately 50 miles northwest of the project area (appendix A).

Plant and soil evaporation, which together make up evapotranspiration, are a function of daily mean solar radiation, temperature, and the leaf area indices of the crops at various stages of the year.

Soil parameters included:

1) Hydraulic conductivity, which is very sensitive and may need calibration.
2) Porosity is also sensitive but is a better-defined quantity that can be obtained from soil surveys.
3) Soil water content at 1/3- and 15-bars tension.
4) Surface roughness in this model is defined as Manning's n factor.

2/ See (2) for modifications made to the model's computer code to account for snowmelt, changes in surface roughness over time, and other problems.

Slope and length of slope were inputs for the hydrology submodel. Hydraulic conductivity and surface roughness were greatly influenced by management practices. Crop parameters, including leaf area index, depth of roots, and winter cover, also affected hydraulic conductivity and surface roughness. Thus, the differences in losses from different activities should be determined primarily in the changes made by the user in hydraulic conductivity and Manning's n factor.

The hydrology submodel was critical in getting reasonable results in the other submodels which provided estimates of stream pollutants measured at the field edge. Good hydrology output is necessary if good estimates of pollution are to be obtained from the model. Overland flow only was calculated using the model, except for terraces where the impoundment ponding option was also used (3).

Output from the hydrology component included runoff per storm or per year, deep percolation, evapotranspiration, and water budgets. The computer passfile included runoff, peak rates of runoff, evapotranspiration, actual and potential water use, soil water, and percolation. This passfile data was then input, or passed, into the erosion component of the model.

Erosion Component

The erosion component included detachment, transport, and deposition. Detachment, a modification of the USLE (Universal Soil Loss Equation), occurs when sediment load is less than transport capacity. Detachment is caused by either raindrop impact or by overland or channel flow. Transport occurs only after ponding has occurred. Hydrologic ponding is the saturation of a surface layer 10-millimeters thick in the hydrology model. When hydrologic ponding occurs, transport can occur in overland flow. Deposition can occur if sediment load exceeds transport capacity, and complex slopes can be considered in the calculation of overland flow. Concentrated channel flow, through either bare or grassed channels, and impoundments (modeled in this study) can also be considered using CREAMS.

The following input data are needed:

1) Hydrology passfile.
2) Coefficients for surface roughness, bulk density, and erodibility.
3) Particle distribution and specific surface area of particles.
4) Slope profiles.
5) Shape, slope, dimension, and other channel inputs.
6) Slope, depth, pipe diameter, intake rate, and drainage area for impoundments (including terraces).
7) Effects of tillage and crop cover on the cropping management factor, the contouring factor, and the surface roughness factor.

Total soil loss is available by storm, month, or year. The particle distribution of the soil lost and the organic matter load were provided in the erosion output. Enrichment of sediment in fine particles was also calculated, and these enrichment ratios, passed on through the erosion passfile to the chemistry component, are important in calculating the transport of pesticides associated with sediment.

The erosion passfile uses information from the hydrology passfile and passes it, along with soil loss and sediment enrichment ratios, on for input to the chemistry component.

Chemistry Component -- Plant Nutrients

The plant nutrients component gives the user estimates of N and P losses at a field scale. The input requirements included:

1) The erosion passfile.
2) Soil survey data.
3) N, NO_3, and P in the soil and soluble N and P.
4) Unitless coefficients and exponents which relate the amount of N and P enriched in sediment and extractable from the soil by runoff.
5) Rainfall N.
6) Parameters for the application and incorporation of N and P.
7) Rooting depths, yields, crop data inputs, and water use.
8) Coefficients that relate the N content of the plant to various stages of plant growth. We used this option where N uptake by plants is based on plant growth and N content.

The CREAMS user manual provided guidelines for selecting the values of these parameters when measured data were not available. Individual storm losses were again available or they were accumulated for monthly or annual summaries only. Output included N and P lost with sediment yield and dissolved in runoff and NO_3 lost in deep percolate. Also there were other processes included in the output such as N mineralization, denitrification, and N uptake by the crop.

Chemistry Component -- Pesticides

Input requirements included the erosion passfile and parameters related to the application of the pesticides. Also necessary were parameters on water solubility, foliar residue half-life, extraction ratio, decay constants, and several other pesticide-specific inputs. Output from the pesticide component is total mass lost and the percentage of the pesticide application lost at the field edge.

MODELING BMPs IN PENNSYLVANIA'S RCWP

Current management practices, or "no BMPs," were chosen to be modeled as a baseline condition for the "without RCWP" scenario. These included conventional spring tillage (one pass with each of the following: mold-board plow, tandem disk harrow, spike-tooth harrow) for each of the crop activities requiring establishment (corn for grain or silage, and alfalfa hay).

Several critical BMPs were chosen for modeling. These included two conservation tillage practices: (1) reduced tillage (one pass with a chisel plow followed by one pass with a tandem disk harrow), (2) no-till planting, (3) 120-foot wide strips,[3] (4) contouring, (5) winter cover, (6) grassed waterways, and (7) pipe-outlet terraces.

3/ We modeled strips 120-feet wide because that was typical in southeastern Pennsylvania. Later information revealed in RCWP contracts suggested that 80- to 100-feet were more typical in the project area. This would reduce surface losses slightly and increase NO_3 leaching losses for practices (3), (4), and (7) from those reported here.

Permanent vegetative cover was handled by using CREAMS to model permanent pasture. Animal-waste management was another BMP that was modeled for 6- and 12-month storage and for daily spreading under varying incorporation practices discussed below. Fertilizer and pesticide management also were assumed as part of all farm-management practices, as described later. Selection of the BMPs modeled accounts for these BMPs as well. Therefore, most of the BMPs in the RCWP project area were considered by the CREAMS modeling.

Those BMPs not considered in CREAMS modeling, but that were applicable to Pennsylvania and will be accounted for in the economic analysis of the RCWP project, included: (1) diversions; (2) grazing land protection systems; (3) stream protection systems (fencing, filter strips, livestock crossings, and livestock water facilities); (4) sediment retention, erosion, or water control structures; and (5) tree planting. None of these BMPs, except diversions, will markedly affect the farm economy in the RCWP project area because few contracts included items 2 through 5.

Selected combinations of BMPs under the tillage practices were also modeled. Terraces were always modeled as being on a contour with 120-foot wide strips (on slopes of 5 percent or more), and winter cover was always modeled under no-till when corn silage was the current crop or the residue.[4] Combined sets of the relevant BMPs (hereafter called "all BMPs"), including either reduced tillage or no-till, have been implemented in the project area and were modeled. Not all the individual BMPs were modeled to determine losses of N and P, but selected individual BMPs and combinations were chosen.

Crops modeled include corn for grain and silage, alfalfa hay, and grass pasture. Crop nutrient requirements (appendix A) were taken from (6). A starter-fertilizer application was modeled for row crops, band-placed at a depth 2 inches below the seed. Manure applications of 40, 30, 20, 15, and 10 tons were modeled for corn. Applications of 20, 10, and 0 tons were considered for grass pasture and establishment-year alfalfa, and 10, 5, and 0 tons for established alfalfa meadows. For crops that did not have their nutrient needs met by manure and starter-fertilizer applications (for example, corn with animal-manure applications of less than 20 tons), additional plant nutrients were modeled as plowed down (or top-dressed under no-till) at the time of tillage.[5]

Fertilizer management, one of the BMPs proposed to reduce nutrient loadings to streams, was handled by assuming different levels of manure applications. For example, a farmer spreading 20 tons per acre of dairy manure (daily spread) and 50 pounds commercial N per acre is applying an equivalent of 30 tons of manure. Therefore, if the farmer has 100 pounds of N available from 20 tons of manure, and the crop needs are 130 pounds of N, good fertilizer management by the farmer

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4/ As stated before, strips were modeled as 120 feet in width, and losses reported in this study were slightly higher in surface runoff and lower in deep percolate than would be the case for 80- to 100-foot wide strips. Likewise, strips on terraces were assumed to be 120 feet in width, rather than the terrace width, so that losses could be compared with those of other practices. For further discussion, see appendix A.

5/ The CREAMS model did not account for ammonia-nitrogen (NH_4-N) inputs or volatilization losses. The N losses associated with NH_4-N volatilization from storage and from surface application were deducted based on published information (4) prior to CREAMS modeling (appendix A).

would result in only an additional 30 pounds of commercial N fertilizer applied. Therefore, spreading 30 tons per acre on some fields is not sound management if only 20 tons per acre are available for the farmer's corn land on a farm-wide, averaged basis. This was the only way fertilizer management could be handled using CREAMS: assume a manure application below or at crop needs and add commercial fertilizer as needed. Fertilizer applications in excess of plant requirements were then viewed as manure-disposal problems and/or poor fertilizer management.

In all cases it was assumed that farmers, given their enterprises and the amount of animal manure produced, used manure and fertilizer rates, timing, and methods of application that minimized nutrient movement. Those farms with excessive numbers of animals had excessive manure nutrients. Likewise, the pesticide management BMP was assumed for all farmers in the watershed. One set of assumptions had to be chosen to avoid greatly expanding the number of runs of the nutrients model. These BMPs normally cost nothing because proper fertilizer and pesticide management encourage plant growth and increase profits while minimizing water-quality degradation. Cost sharing is considered only when fertilizer management results in split applications of fertilizer or additional expenses for application (such as equipment rental). Therefore, good management was modeled instead of poor management.

Manure management and disposal were major concerns in Pennsylvania's RCWP project area. Production and nutrient contents of animal manures were calculated from (5). Daily spreading, 6-month storage, and 12-month storage systems were considered in modeling nutrient losses from cropping. Manure was modeled as mixed manure, with nutrient content weighted according to the contribution of each type of livestock in the study area (see appendix A for the nutrient content of animal manure and for assumptions associated with each manure-management system).

For modeling simplicity, daily spreading was assumed to coincide with a high level of management. The assumptions made for modeling were: (1) no barnyard losses, in that all manure nutrients were available for field application except those lost in storage and application; (2) no spreading on frozen or snow-covered ground (although this possibility was considered for selected crops on a 5-percent slope); and (3) no spreading within 2 days of major precipitation expected to occur. As a result, nutrient losses in surface runoff presented here may understate true losses for a typical daily-spreading system.

The assumptions for a typical farmer in the area allowed comparison of the types of application (surface spreading versus incorporation) and length of storage. It is impossible for farmers to spread manure every few days and avoid spreading within 2 days of a major precipitation event. These assumptions did not introduce management biases; that is, farmers with storage were not assumed to manage manure nutrients better than farmers who spread daily. High levels of management also were assumed for manure-storage systems. The reader should refer to appendix A for a description of when manure was applied for each crop under different storage and application systems.

Duffield silt loam, the primary soil series in the Little Conestoga Creek watershed, is a deep, well-drained, and highly productive soil that has high moisture-holding capacity. Three slopes were modeled--A (0-3 percent), B (3-6 percent), and C (6-12 percent)--as average overland slopes of 2, 5, and 9 percent, respectively. In addition, a Lindside silt loam with a slope of 1.5 percent was modeled because this soil adjoined the Little Conestoga Creek and other flood-plain areas. It was modeled only as pasture, which accounted for approximately 85 percent of the land

use of this soil. No differences in yields were assumed for different slopes and practices.

A large number of crop/slope/fertilization/manure storage combinations had to be considered in this study. Therefore, due to the many scenarios, not all the BMPs modeled in the erosion component were considered in the chemistry plant-nutrients component. Baseline practices, or no BMPs, were necessary to obtain pollution estimates for farms not implementing BMPs (both before and after the RCWP). Terraces were modeled because they were expensive and they incorporated the additional BMPs of contoured 120-foot strips. Winter cover crops were also incorporated in the modeling of no-till, so that the only BMP modeled in the erosion component but not in the plant-nutrients component was grassed waterways. However, the final option modeled in the plant-nutrients component was all BMPs under reduced tillage, so tradeoffs among BMPs for reducing chemical pollution can be determined for all the modeled BMPs.

The effects of BMPs on pesticide losses were also critical in Pennsylvania's RCWP project area. Pesticide management was not conducive to analysis using CREAMS alone. Although pesticide applications varied for each crop and tillage practice, it was useful to study the effects of proposed BMPs on field-edge losses for a single pesticide. Atrazine is normally applied to corn land at a rate of 1 pound per acre. To compare the effects of BMPs, continuous corn silage and continuous corn grain were modeled for the Duffield silt loam on all slopes to determine the effects of BMPs at a given application rate. For conventional and reduced tillage, atrazine was modeled at 1 pound per acre, applied on the surface after planting. Because no-till planting usually requires more herbicides for weed control, an application of 1.5 pounds per acre after planting was modeled. This no-till application was not necessarily an agronomic recommendation, but it was used here for comparative purposes.

INTERPRETATION OF THE CREAMS RESULTS

We used the CREAMS model to evaluate water-quality effects for a wide range of BMP scenarios. The data generated from this modeling will be incorporated into an economic evaluation of the physical and economic effects of RCWP. By combining CREAMS estimates with BMP cost information and farm budgets, it was possible to judge the water quality and cost effects of instituting BMPs. It can be determined which BMPs are cost effective for controlling pollutants or combinations of pollutants. For example, it may be found that conventional tillage is the cheapest way to prevent NO_3 leaching and no-till may prove better for reducing soil loss, but a third alternative such as reduced tillage may be better if both types of pollution are to be constrained. Considerable insight into the effects of BMP adoption on water quality and on net farm returns can be derived from direct analysis of the CREAMS-modeling results and farm budgeting data.

Soil and chemical losses were estimated for typical field situations within the boundaries of the Conestoga Headwaters RCWP project area. This report presents the CREAMS output for soil, N and P losses for selected field conditions, and a herbicide's (atrazine) losses (atrazine losses were modeled for continuous corn grain and continuous corn silage only). The results from the nutrient modeling are voluminous due to the number of parameters generated and the evaluation of five levels of manure loading for each BMP scenario. Complete losses of N and P are presented in appendix B.

CREAM results are on a calendar-year basis instead of a crop-year basis. Thus, if the residue is alfalfa, followed by a corn silage crop, the contribution to erosion and runoff estimates for alfalfa occurs from January 1 until tillage operations are initiated for corn. The remainder of the losses were attributable to the corn silage crop.

Soil Losses

Soil losses at the field edge ranged from a high of 28 tons per acre for corn silage following corn silage on a 9-percent slope and with no BMPs to less than 0.1 ton per acre for pasture and for established alfalfa meadow on a 2-percent slope (tables 1 through 4). If all BMPs (a combined set of BMPs) with no-till planting is assumed, soil loss of 28 tons per acre for corn silage following corn silage on a 9-percent slope can be reduced to 2.2 tons per acre, or a 92-percent reduction in soil loss.

The soil losses presented applied to one calendar year only. If crop rotations are to be evaluated, the results of the respective cropping patterns need to be combined. For example, average annual soil losses for 2 years of corn silage followed by 3 years of alfalfa on a 9-percent slope with reduced tillage were:

$(7.77 + 16.32 + 1.92 + 1.21 + 1.21)/5 = 5.69$ tons per acre per year.

For corn silage following corn silage on a 5-percent slope, stripcropping reduced soil loss by 22 percent compared with conventional practices, while contouring and stripcropping reduced soil loss by 39 percent (table 2). Terraces with 120-foot slope length reduced soil loss by 72 percent. Sod waterways, also structural practices, reduced soil loss by 64 percent. Winter cover crops reduced soil loss by 14 percent. Reduced tillage reduces losses by 44 percent, or by 89 percent when combined with stripcropping and contour cropping, terraces, winter cover crops, and a grassed waterway. No-till reduced losses by 68 percent (with appropriate residue management, which in this case would be winter cover), and by 93 percent when combined with the other reduced-tillage practices. Greater use of hay and pasture crops benefited soil conservation (table 4).

Without soil-conservation BMPs, an increase in field slope dramatically affected soil loss. Corn grown on a 2-percent slope displayed soil losses approximately 25 percent of those on a 5-percent slope and only 10 percent of those on a 9-percent slope (tables 1-3). With all BMPs in place under reduced tillage or no-till, the relative differences between 2-percent slope land and the 5- and 9-percent slope land were reduced considerably (largely due to pipe-outlet terraces on 5- and 9-percent slope land).

Nutrient Losses

The range of manure handling options that were modeled complicated interpretation of the CREAMS results for nutrient losses. Manure was modeled as daily spread (two to four applications at a single location on each field per year), stored for 6 months (two applications per year), or stored for 12 months (one application per year). Manure could be spread on the surface, plowed down, or injected. In addition, five levels of manure applications were modeled, ranging from 10 to 40 tons per acre.

The volume of data generated from the nutrient model was difficult to interpret directly. To reduce the massive data to a manageable level and to discern patterns in the estimates of nutrient losses, selected data items were separated into summary tables. The results presented in the summary tables hold throughout

Table 1--CREAMS estimates of erosion losses for corn silage and corn grain on a 2-percent slope

Crop and management practice	Previous Crop: Corn silage	Corn grain	Alfalfa
		Tons per acre	
Corn silage:			
No BMPs	2.76	2.32	1.77
120-foot strips	2.46	2.06	1.58
Contoured strips	2.05	1.74	1.35
Winter cover	2.41	1.99	1.45
Grassed waterway	.85	.87	.93
Reduced tillage	1.60	1.02	.67
All BMPs* and reduced tillage	.87	.57	.42
No-till	.87	.56	.29
All BMPs* and no-till	.60	.30	.21
Corn grain:			
No BMPs	2.38	1.95	1.43
120-foot strips	2.14	1.75	1.27
Contoured strips	1.73	1.41	1.03
Winter cover	2.35	**NM	**NM
Grassed waterway	.75	.79	.84
Reduced tillage	1.25	.76	.39
All BMPs* and reduced tillage	.81	.50	.39
No-till	.67	.36	.15
All BMPs* and no-till	.41	.22	.14

* All BMPs include terraces, contouring, stripcropping, residue management, and sod waterways.
** NM = Not modeled.

the data presented in appendix B: the general relationships among BMPs, nutrient loadings, and percentage slope on field losses were fairly consistent throughout the nutrient output. Complete estimates of nutrient losses are presented in appendix B. Tables in appendix B reveal nutrient losses in solution, sediment, and percolate phases. CREAMS is a comparative model and results should be interpreted on that basis, comparing losses among practices and not comparing them with real losses.

The primary effect of BMPs was on surface losses of nutrients, where approximately 58 percent of the total N lost was lost from the surface (dissolved in runoff or attached to sediment) in the no BMP case (table 5). However, when the full set of BMPs was modeled, approximately 75 percent of total N losses were subsurface percolate losses. Percolate losses of NO_3 increased slightly in the terraces and all BMP cases over the no BMP cases. These trends were consistent throughout the data presented in appendix B. Subsurface losses also frequently increased for reduced tillage. When surface losses of N were restricted through the use of

Table 2--CREAMS estimates of erosion losses for corn silage and corn grain on a 5-percent slope

Crop and management practice	Previous crop		
	Corn silage	Corn grain	Alfalfa
	Tons per acre		
Corn silage:			
No BMPs	10.84	9.15	7.08
120-foot strips	8.45	7.22	5.69
120-foot terraces	3.09	2.63	2.06
Contoured strips	6.56	5.65	4.57
Winter cover	9.34	7.65	5.59
Grassed waterway	3.90	3.86	3.81
Reduced tillage	6.11	4.01	2.92
All BMPs* and reduced tillage	1.20	.82	.63
No-till	3.48	2.33	1.39
All BMPs* and no-till	.76	.46	.38
Corn grain:			
No BMPs	8.97	7.34	5.35
120-foot strips	7.00	5.76	4.24
120-foot terraces	2.66	2.18	1.64
Contoured strips	5.05	4.15	3.09
Winter cover	8.97	**NM	**NM
Grassed waterway	3.43	3.43	3.37
Reduced tillage	4.50	2.69	1.68
All BMPs* and reduced tillage	1.03	.64	.49
No-till	2.54	1.41	.77
All BMPs* and no-till	.50	.28	.19

* All BMPs include terraces, contouring, stripcropping, residue management, and sod waterways.
** NM = Not modeled.

BMPs, more N was available for subsurface loss. Thus, if the goal is to protect groundwater resources, adopting BMPs may be counterproductive or at least nonproductive. BMPs can result in significant reductions in total N losses.

Table 6 shows the influence of corn-cropping patterns on nutrient losses (the effects of prior crops are only for the period from January 1 through the initiation of tillage). Total losses of N and P were lower when corn followed alfalfa. However, percolate losses of NO_3 were greatest when corn followed alfalfa as a result of potential N fixation in the root zone by alfalfa.

The percentage slope assumed for the field greatly influenced surface losses of N and P, especially when no BMPs were modeled. Changes in the slope of the field surface did not significantly affect percolate losses of NO_3 (table 7). Losses of NO_3-N for no BMPs, with manure applications at the project average

Table 3--CREAMS estimates of erosion losses for corn silage and corn grain on a 9-percent slope

Crop and management practice	Previous crop		
	Corn silage	Corn grain	Alfalfa
		Tons per acre	
Corn silage:			
No BMPs	28.43	24.03	18.64
120-foot strips	21.61	18.35	14.45
120-foot terraces	7.93	6.72	5.28
Contoured strips	18.33	15.70	12.57
Winter cover	24.62	20.25	14.86
Grassed waterway	9.46	9.38	9.11
Reduced tillage	16.32	10.79	7.77
All BMPs* and reduced tillage	3.27	2.18	1.66
No-till	9.82	6.74	4.15
All BMPs* and no-till	2.21	1.30	.91
Corn grain:			
No BMPs	24.38	20.01	14.67
120-foot strips	17.88	14.64	10.80
120-foot terraces	6.63	5.40	4.01
Contoured strips	14.56	11.98	8.83
Winter cover	24.35	**NM	**NM
Grassed waterway	8.46	8.48	8.21
Reduced tillage	12.52	7.64	4.60
All BMPs* and reduced tillage	2.93	1.76	1.41
No-till	7.57	4.51	2.50
All BMPs* and no-till	1.54	.89	.59

* All BMPs includes terraces, contouring, stripcropping, residue management, and sod waterways.

** NM = Not modeled.

of 40 tons per acre on corn silage, were 54 pounds per acre (appendix tables B-6, B-12, B-18). This corresponded to a groundwater concentration of almost 25 mg/l. This was the approximate groundwater NO_3-N concentration for many wells on area farms where excess nutrients were applied to land that was primarily in continuous corn. The CREAMS model reasonably predicted NO_3 leaching and other losses, based on preliminary monitoring data (7).

Table 8 illustrates the effects of manure loading on nutrient losses. Reducing animal-manure loading of nutrients from 40 to 20 tons per acre reduced total N and P losses by 40 percent each in the no BMPs case. Similar reductions occurred when manure loadings were decreased in the all BMPs case. Note that nutrient losses were smaller at 10- and 15-tons per acre loadings because commercial fertilizer was added to meet crop needs.

Table 4--CREAMS estimates of erosion losses for alfalfa and permanent pasture

Crop and management practice	Percentage slope		
	2	5	9
	Tons per acre		
Direct seeded alfalfa:			
No BMPs	0.23	0.96	2.84
120-foot strips	.19	.81	2.32
120-foot terraces	*NM	.30	.80
Contoured strips	.18	.73	2.26
Grassed waterway	.15	.68	1.90
Reduced tillage	.14	.67	1.92
All BMPs** and reduced tillage	.10	.17	.45
No-till	.12	.52	1.64
All BMPs** and no-till	.08	.13	.38
Established alfalfa meadow:			
No BMPs	.10	.49	1.21
120-foot strips	.08	.37	.97
120-foot terraces	*NM	.14	.35
Contoured strips	.07	.27	.78
Grassed waterway	.07	.35	.86
All BMPs**	.05	.08	.26
Permanent pasture***:			
No BMPs	.07	.28	.72

* NM = Not modeled.

** All BMPs include terraces, contouring, stripcropping, residue management, and sod waterways.

*** Erosion for permanent pasture on a 1.5-percent slope adjacent to a stream is 0.04 ton per acre.

Daily spreading of manure was modeled as two to four applications of manure to each field throughout the year. We assumed that manure was not applied immediately preceding or during a rain, on top of snow, or on frozen ground. Daily spreading with two of the applications of manure on frozen ground yielded results virtually identical to the results reported for daily spreading.

Estimates for daily-spreading losses were lower than expected relative to losses with storage, especially when considering spreading on frozen ground. Volatilization losses of N were assumed to be much greater under a system of daily spreading. Good management was assumed for daily spreading, but the losses appeared low for winter spreading. This probably had to do with two problems within the model. First, runoff may be unrealistically low from snowmelt and frozen ground despite modifications made to the model (2). Second (and more problematic for this study), CREAMS cannot be used to model the application of manure directly, but

Table 5--Effects of BMPs on nutrient losses for corn silage following corn silage, with a 5-percent slope, 30 tons per acre of manure, and daily spread

BMP	Nitrogen losses			Phosphorus losses
	Percolate	Surface	Total	
		Pounds per acre		
No BMPs	50	68	118	31
Terraces	52	29	82	12
Reduced till	50	45	95	20
No-till	45	33	78	14
All BMPs*	54	14	69	5

* All BMPs include terraces, contouring, stripcropping, residue management, and sod waterways.

Table 6--Effects of cropping pattern on nutrient losses for corn, a 5-percent slope, daily spread, 30 tons per acre of manure, and no BMPs versus all BMPs

Cropping pattern	Nitrogen losses			Phosphorus losses
	Percolate	Surface	Total	
		Pounds per acre		
No BMPs:				
Corn grain following--				
Corn silage	49	67	109	26
Corn grain	49	53	103	23
Alfalfa	57	42	99	17
Corn silage following--				
Corn silage	50	68	118	31
Corn grain	50	61	111	28
Alfalfa	60	51	111	22
All BMPs*:				
Corn grain following--				
Corn silage	50	15	65	5
Corn grain	50	16	66	5
Alfalfa	60	12	72	3
Corn silage following--				
Corn silage	54	15	69	5
Corn grain	54	145	68	5
Alfalfa	65	12	77	4

* All BMPs include terraces, contouring, stripcropping, residue management, and sod waterways.

Table 7--Effects of percentage slope on nutrient losses for corn silage following corn silage, 30 tons per acre of manure, daily spread, and no BMPs versus all BMPs

Percentage slope	Nitrogen losses			Phosphorus losses
	Percolate	Surface	Total	
		Pounds per acre		
No BMPs:				
2	50	27	7	11
5	50	68	118	31
9	50	141	191	68
All BMPs*:				
2	52	12	64	4
5	54	14	69	5
9	54	27	81	12

* All BMPs include terraces, contouring, stripcropping, residue management, and sod waterways.

Table 8--Effects of manure loadings on nutrient losses for corn silage following corn silage, with a 5-percent slope, daily spread, and no BMPs versus all BMPs

Manure loading	Nitrogen losses			Phosphorus losses
	Percolate	Surface	Total	
Tons per acre	----------	Pounds per acre	----------	
No BMPs:				
10	27	36	63	16
15	31	36	67	16
20	35	52	86	25
30	50	68	118	31
40	54	89	143	42
All BMPs*:				
10	30	9	39	3
15	34	9	43	3
20	38	12	49	4
30	54	14	69	5
40	59	22	81	8

* All BMPs include terraces, contouring, stripcropping, residue management, and sod waterways.

rather the nutrient components of the manure. Therefore, a true surface application was difficult to model because the nutrients were assumed to percolate and be mixed into the soil, whereas manure nutrients may be on the surface and available to direct runoff (especially when spread on frozen ground).

For these reasons, it was difficult to compare daily-spreading losses in surface runoff with losses under storage. N losses due to volatilization were expected to be significant, however. Also, as a result of the way the model works, the NO_3 losses in deep percolate under daily spreading were probably overestimated, making the total N losses somewhat closer to the true NO_3 losses. Therefore, it may be possible to compare total N losses under daily spreading with those under storage with some confidence. P losses were only estimated in surface runoff; therefore, the same confidence does not hold true. Comparison among field-applied BMPs under any storage period (daily to 12 months) was not affected by this modeling short-coming, nor was comparison among different types of storage and methods of incorporation (comparing losses for 6-month storage with plowdown or injection with those for 12-month storage with plowdown or injection, respectively).

Table 9 illustrates the influence of manure storage on nutrient losses. At a 20-tons-per-acre application rate, total losses were similar for 6-month storage with plowdown or injection and 12-month storage with plowdown and daily spreading. Injection of manure following 12 months of storage resulted in lower percolate losses of NO_3, which means lower total losses of N.

An interesting phenomenon resulted when manure loadings were increased to 40 tons per acre. Total N losses actually increased with storage compared with daily spreading. When the manure was injected at the 40-tons-per-acre loading, losses were higher than when the manure was plowed down. When manure was stored in an appropriate storage facility and incorporated immediately following application, more N was assumed to be available per ton of manure compared with daily spreading (for which volatilization losses can reduce manure N by approximately 50 percent). Thus, stored manure provided more plant-available N (if incorporated) than did daily-spread manure. At the lower levels of manure loading (20 tons per acre), injection reduced N losses, while injection increased N losses at the higher loading rate (40 tons per acre).

In the case of 12-month storage, the N was made available in the root zone when the crop was growing. At normal N fertilizer rates, crop uptake of nutrients made injection a good alternative for preventing surface-runoff losses of N and P as well as percolate NO_3 losses. Applying excess N negated the advantage of injection for preventing NO_3 losses, although surface losses of nutrients were still reduced.

The results for injection did not conform to our expectations at high levels of manure application. It was expected that injection reduced nutrient losses, but the CREAMS results did not support this contention. There are two explanations for this result. First, the CREAMS model was not developed to handle applications of manure directly. Manure nutrients entered into the soil as their chemical constituents (as discussed previously in regard to modeling daily spread). In addition, the soil profile was assumed to contain a uniform distribution of plant nutrients in the surface layer of soil that was available for detachment and for extraction of nutrients in surface runoff. Thus, it was especially difficult to model manure injection with CREAMS. Second, injection of manure conserved nutrients, especially N, through prevention of volatilization losses. When excess N already exists, nutrient conservation implies that more nutrients will be

Table 9--Effects of storage period on nutrient losses for corn silage following corn silage with a 5-percent slope, 20 and 40 tons per acre of manure, and all BMPs*

Application	Nitrogen losses			Phosphorus losses
	Percolate	Surface	Total	
		Pounds per acre		
20 tons per acre:				
Daily spread on surface	37	12	49	4
6-months storage with plowdown	40	11	51	4
6-months storage with injection	40	12	52	4
12-months storage with plowdown	29	12	41	4
12-months storage with injection	18	13	31	4
40 tons per acre:				
Daily spread on surface	59	22	81	8
6-months storage with plowdown	73	19	92	7
6-months storage with injection	77	21	98	7
12-months storage with plowdown	55	21	76	7
12-months storage with injection	64	25	89	7

* All BMPs include terraces, contouring, stripcropping, residue management, and sod waterways.

available for loss from the fields. We feel that this latter explanation is at least partially responsible for higher estimated losses and the total N losses for manure injection were reasonable estimates. At lower manure loadings, the conservation effects of injection may be positive to farmers; but at higher rates, the increased NO_3 losses to groundwater appear substantial.

Atrazine Losses

To examine the effects of BMPs on pesticide losses, atrazine was modeled for continuous corn grain and continuous corn silage. Atrazine was modeled as a soil surface application after planting. Application rates, typical of those in Lancaster County, were 1 pound per acre for conventional and reduced tillage and 1.5 pounds per acre for no-till.

Tables 10 and 11 reveal that field-applied BMPs did not significantly affect atrazine losses because atrazine was applied for weed control after the seedbed was prepared and just before plants emerged. Reduced tillage was the most influential single BMP for reducing losses at a given application rate. Terraces also reduced field losses. The percentage of the application that was lost under no-till declined relative to no BMPs as steeper slopes were examined. However, no-till required heavier herbicide applications (50 percent more in our hypothetical treatment) and total pesticide losses would probably be greater under no-till.

Tables 10 and 11 also illustrate the differences in losses between corn grain and corn silage. Virtually no difference existed on flatter slopes, but small increases in losses are displayed for silage relative to grain on steeper slopes because the application was modeled at the beginning of the growing season, and very little residue was left after silage harvest.

COST EFFECTIVENESS OF BMPs

Abating nutrient losses depended on good fertilizer and manure management. Proper nutrient management should reduce total farm nutrient losses and increase farm profits for those farmers who purchased excessive commercial fertilizer. Likewise, proper application rates and techniques should maximize profits. Therefore, nutrient and pesticide management should be justified on the basis of profit-maximizing behavior by the farmer.

The CREAMS modeling indicated that, depending on the slope, 50 to 90 percent of all surface runoff losses of N from corn land was sediment-associated. Practices which restrict soil and water movement also restrict surface runoff losses of N and P. Tables 1-9 illustrate the estimated effects of some of the BMPs on soil and nutrient losses. Technical assistance will be necessary to achieve sound management for controlling surface and percolate losses of pollutants. This assistance should be provided in a way which has the least effect on farm income. The results from the CREAMS modeling could be used to guide sound management of cropland (summarized in the implications section of this report).

Table 12 combines cost information with field losses of soil and nutrients to illustrate the cost effectiveness of BMPs for reducing losses. Costs shown are average annual implementation costs, assuming a 5-year lifespan of nonstructural practices and a 10-year lifespan of structural practices. In most cases, the costs to the farmer would be less than those shown due to Government cost sharing and tax writeoffs for depletion and depreciation.

Table 10--CREAMS estimates of atrazine losses for continuous corn grain

Management practice	Slope	Percentage of application lost*
		Percent
No BMPs	2	1.99
120-foot strips	2	1.98
Contoured strips	2	1.98
Grassed waterway	2	1.97
Reduced tillage	2	1.76
All BMPs and reduced tillage	2	1.80
No-till	2	2.09
All BMPs** and no-till	2	2.08
No BMPs	5	2.05
120-foot strips	5	2.03
Terraces	5	1.86
Contoured strips	5	2.01
Grassed waterway	5	2.00
Reduced tillage	5	1.78
All BMPs and reduced tillage	5	1.79
No-till	5	2.10
All BMPs** and no-till	5	1.77
No BMPs	9	2.21
120-foot strips	9	2.14
Terraces	9	1.91
Contoured strips	9	2.11
Grassed waterway	9	2.07
Reduced tillage	9	1.85
All BMPs and reduced tillage	9	1.81
No-till	9	2.13
All BMPs** and no-till	9	1.77

* Atrazine is assumed to be applied to conventionally and reduced tillage corn at the rate of 1 pound per acre. No-till corn is assumed to have atrazine applied at the rate of 1.5 pounds per acre.

** All BMPs include terraces, contouring, stripcropping, residue management, and sod waterways.

Among the nonstructural practices, conservation tillage--reduced tillage and no-till--was effective in reducing pollutant losses and costs nothing to implement. Other benefits such as reduced soil compaction and increased moisture-holding capacity make this BMP a critical element in any economically-sound nutrient and soil management program. The deep, well-drained soils typical in the project area should provide crop yields under conservation tillage equal to those with conventional tillage in normal years (1). Crop yields may actually be higher for conservation-tilled land relative to conventionally-tilled land when rainfall is significantly below average. For continuous corn silage, a winter cover crop was necessary for the proper use of conservation tillage. However, a winter cover crop should reduce runoff when

Table 11--CREAMS estimates of atrazine losses for continuous corn silage

Management practice	Slope	Percentage of application lost*
		Percent
No BMPs	2	1.99
120-foot strips	2	1.99
Contoured strips	2	1.98
Winter cover**	2	1.99
Grassed waterway	2	1.97
Reduced tillage	2	1.76
All BMPs and reduced tillage***	2	1.80
No-till	2	2.09
All BMPs and no-till	2	2.08
No BMPs	5	2.08
120-foot strips	5	2.05
Terraces	5	1.87
Contoured strips	5	2.02
Winter cover**	5	2.08
Grassed waterway	5	2.00
Reduced tillage	5	1.81
All BMPs and reduced tillage	5	1.80
No-till	5	2.11
All BMPs and no-till	5	1.77
No BMPs	9	2.27
120-foot strips	9	2.19
Terraces	9	1.93
Contoured strips	9	2.14
Winter cover**	9	2.27
Grassed waterway	9	2.07
Reduced tillage	9	1.92
All BMPs and reduced tillage***	9	1.83
No-till	9	2.17
All BMPs and no-till***	9	1.78

* Atrazine is assumed to be applied to conventionally and reduced tillage corn at the rate of 1 pound per acre. No-till corn is assumed to have atrazine applied at the rate of 1.5 pounds per acre.

** Atrazine is applied after tillage operations, so winter cover does not affect pesticide losses; therefore, the losses for winter cover are the same as those for no BMPs.

*** All BMPs include terraces, contouring stripcropping, residue management, and sod waterways.

residue is removed regardless of tillage practices. Therefore, the costs for winter cover should not be included in the costs of the conservation-tillage systems. The only clear disadvantages of conservation tillage were the capital outlays required to convert tillage equipment (possibly before the farmer might otherwise purchase tillage equipment) and the possibility of increased reliance

Table 12--The costs and effectiveness of conservation practices for continuous corn silage with daily spread on a 5-percent slope, 20 tons manure per acre

Conservation practice	Estimated annual cost per acre	Soil saved per acre	Nitrogen in surface runoff saved	Total nitrogen saved	Total phosphorus saved
	Dollars	Percent			
Conventional practices	N/C	0	0	0	0
Permanent vegetative cover	30.00*	95	87	45	91
Contour stripcropping	N/C	39	30##	18##	33##
Winter cover and residue management	0 to 20**	14	11##	8##	13##
Chisel plowing/reduced tillage	N/C	44	34	20	37
No-till	N/C	68	50	38	54
Terrace system	55.70***	72	56	32	62
Diversion system with 20-foot wide grass filter strip	10.25***	43#	42##	24##	46##
Waterway system	6.90***	64	49##	29##	52##
Reduced tillage with terraces, contouring, stripcropping, residue management, and sod waterway	90.00***	89	78	43	82

N/C = No cost.

* Costs are annualized at 7.875-percent interest over 5 years (life of the practice) and do not include value of foregone production.

** Costs of winter cover and residue management vary according to crop residue.

*** These costs are approximated on a basis of per acre served by averaging the cost per acre served in RCWP contracts. Costs are annualized at 7.875-percent interest over 10 years.

Source: (7).

Estimated based upon soil loss and CREAMS estimates associated with other BMPs.

on herbicides to control weeds normally controlled by deep tillage. Herbicides incorporated into the soil during tillage or planting, combined with the reduced runoff associated with conservation tillage, may help alleviate the latter problem.

Permanent vegetative cover will control many pollutant problems, but should only be considered in critical areas because of its high cost to both farmers and Government (50-percent cost sharing was provided) and because of the opportunity costs of eliminating the land from row-crop or rotation-forage production. Other nonstructural practices included residue management, stripcropping, and contouring. Strip and contour cropping required more labor to establish, plant, fertilize, spray, and harvest than did conventional practices, but the RCWP area farmers' costs were the same with contouring and stripcropping after the strips were established. Inasmuch as farmers signed contracts with no or little cost sharing, these two practices were cost effective because their assumed cost was small.

Structural practices were not applied on a per-acre basis and were slightly more difficult to evaluate. Costs shown in table 12 represent average costs of the practices per acre served for contracts signed in the RCWP project. One practice not shown in table 12, the stream protection system (livestock fence), keeps livestock out of the stream and thus prevents them from adding nutrients directly to the waterway. Prevention of stream losses of N, P, and fecal coliform bacteria due to fences could be substantial but would depend on the number of animals.

Other practices included terraces, diversions, and sod waterways. Terraces were much more expensive, retained nutrients and soil more uniformly throughout the field compared with diversions and sod waterways, and were effective in those cases where much control was needed in addition to those obtained through nonstructural practices.

The protection and enhancement of agricultural productivity was a benefit of RCWP at the farm level, but it presently cannot be quantified. Practices which retained soil on the field (conservation tillage, crop-residue management, winter cover crops, contour stripcropping, and terraces) conserved topsoil in Lancaster County. Prior to RCWP average annual erosion from cropland averaged more than two times the critical soil-loss tolerance level.

Practices which reduced field runoff also conserved valuable nutrients for crop production. For example, the full set of BMPs modeled can be installed at $90 per acre annually (table 12). At 20 tons of manure per acre per year, 36 pounds of N could be saved each year (table 8) at a $10 value ($.28/pound N) plus the savings of P, potash, and organic matter. Without the cost of expensive structural practices, particularly terraces, the benefits of nutrient and organic-matter retention on the field may outweigh the costs of those practices. For example, if the only conservation practice applied was reduced tillage, a savings of 23 pounds total N and 11 pounds P is possible when manure is applied at 30 tons per acre (table 5).

IMPLICATIONS

Many soil-conservation practices were available to participants in the Conestoga Headwaters RCWP project area for reducing their field-runoff losses and, to a lesser extent, groundwater NO_3 losses. Excessive soil loss resulted in reduced

agricultural productivity, obstructions to normal tillage operations, siltation of waterways and impoundments, and other technological externalities which impose costs on downstream users (such as increased costs of water treatment, degraded fishing and recreational values, reduced aesthetic values, and obstructions to transportation). Excessive losses of nutrients and pesticides from agricultural land resulted in higher costs to farmers, decreased quality of on-farm and off-farm drinking supplies (which can be toxic to other organisms at much lower chemical concentrations than those for people and domestic animals), and other off-farm effects.

It is in the farmers' interests in the Conestoga Headwaters RCWP project area and elsewhere in the lower Susquehanna River Basin to adopt BMPs with Federal cost sharing that will control agricultural nonpoint source pollution. There is adequate information from the CREAMS estimates to determine the implications for management practices to alleviate each of the components of nonpoint source pollution.

Reducing Soil Loss

No-till planting was the most cost-effective BMP for reducing soil loss. In cases of rapid runoff, such as corn silage following a residue of silage, only terraces reduced soil loss more effectively than no-till. In all other cropping activities, no-till was equally effective as terraces, and the percentage reduction in soil loss per dollar of total cost was much lower (table 12).

Reduced tillage was another low-cost and effective measure to reduce erosion. Farmers also may be more willing to adopt reduced tillage than no-till because of less management risk (such as proper temperature and moisture conditions at planting time) and fewer weed and insect problems.

Contouring, and especially contour stripcropping, also provided substantial soil savings. Winter cover crops also markedly reduced erosion when corn silage was the current crop. Including alfalfa in rotation with corn or growing permanent hay or pasture greatly reduced total farm losses of soil (compare table 4 with tables 1-3).

Grassed waterways were effective in controlling concentrated flow erosion. However, erosion other than in the waterway will not be controlled. In this way, stream pollution is reduced and the field may be prevented from forming deep gullies, but there is still substantial soil movement in other parts of the field.

There was not generally a single field-conservation practice adequate for controlling nonpoint pollution. A combination of management practices were generally necessary on erodible land. All BMPs, as defined in this study, obviously reduced soil loss to a much greater degree than did individual BMPs. All BMPs under no-till were much more effective than all BMPs under reduced tillage, but the arguments of less risk, less management expertise, fewer pest problems, and practices more similar to conventional tillage may provide reduced tillage with an advantage for acceptability and implementation over no-till. Selective use of various combinations of BMPs are more representative of what is being done in the RCWP project, like the idea of resource-management systems which included a number of soil conservation practices, animal waste and nutrient management, and pesticide management.

Because 75-percent cost sharing was provided to farmers for structural practices, these practices may attract farmers to control surface runoff without requiring

them to significantly alter their management practices. Such practices may not be cost effective for taxpayers. Achieving cost-effective reductions in pollution entails applying the most cost-efficient combination of practices to achieve the desired reductions. Careful targeting of the land to be treated and defining the needed reductions are necessary before water-quality goals can be met at minimum costs.

Reducing Nutrient Loss

In addition to the BMPs considered for reducing soil loss, we also considered manure storage and different methods of incorporation which affect field losses of nutrients. Both 6- and 12-month storages were modeled, and methods of incorporation included surface application, plowing immediately after application, and injecting liquid manure.

The first components of nutrient loss to be discussed are surface losses of N and P, carried with suspended sediment or dissolved in runoff, delivered to the edge of the field. Among the individual BMPs, the no-till and reduced tillage systems and terraces substantially reduced surface losses of N and P. The performance among these three BMPs for reducing surface losses of N was very similar, while no-till yielded a slight improvement in reducing P losses. Because of costs, no-till and reduced tillage are preferred first courses of action to reduce nonpoint source pollution. All BMPs under either form of conservation tillage reduced surface losses of nutrients markedly better than did individual BMPs and should be pursued on farms with critical erosion and surface nutrient-loss problems. Although grassed waterways were not modeled, we expect edge-of-field losses in surface runoff to approximate those for no-till as in the erosion losses (table 12). However, nutrients in grassed waterways were concentrated in the waterway and not retained on the field in a uniform distribution that benefited the farmer growing crops with less fertilizer. Therefore, conservation tillage is recommended as a first option to prevent surface movement of nutrients, thus cutting crop-production costs and levels of nutrients in waterways and streams.

Another option to control surface losses of nutrients is to grow less corn. Appendix tables B19-B21 display much lower losses of nutrients in surface runoff for alfalfa and grass than for corn. It may be a problem to grow more hay and pasture for those farmers with many animals per acre. It may be impossible to safely use manure on the farm and grow substantial acreage of hay when manure exceeds 20 to 30 tons per acre of dairy manure equivalent (roughly 200 to 300 pounds N per acre). Hauling manure to an offsite disposal site may be a better solution.

Nitrate lost in deep percolate that leaches out of the root zone was a critical component of plant nutrient losses in the Conestoga Headwaters RCWP project area. Drinking water may be toxic when concentrations of NO_3-N exceed 10 mg/l; and many wells in the RCWP area had concentrations two to three times above the critical level (7).

No-till was an effective alternative for reducing NO_3 losses in percolate, especially when manure was spread on the surface or when injected at manure loadings of 20 tons per acre or less. Nutrients tended to accumulate in the upper layers of the soil when no-till was used, perhaps making N more available for plant uptake and denitrification and less likely to be leached. No-till was better than reduced tillage and almost as effective as terraces for reducing surface losses of N and

P (appendix B). Therefore, no-till effectively controlled field movement of nutrients at substantially lower costs than those for structural practices.

Terraces, reduced tillage, and all BMPs under reduced tillage displayed greater NO_3 losses in deep percolate than did no BMPs in most cases (appendix B). This is especially true for corn, whereas all BMPs had slightly lower losses than did no BMPs when alfalfa was considered, and terraces were similar to no BMPs.

Storing manure for 6 months appeared to increase NO_3 leaching because manure nutrients were conserved and then applied in the fall when plant uptake is minimal or nonexistent. Twelve-month storage allowed nutrients to be applied in the spring when crop growth occurs, and thus reduces NO_3 losses in percolate.

Of the two methods of application with 12-month storage, plowing manure under was a better method than injection for controlling NO_3 losses at manure loadings of 40 tons per acre (appendix B). Injection was a better technique for controlling NO_3 leaching losses when normal loadings of 20 tons per acre or less were applied. Therefore, injection appeared to be a preferable technique when manure loadings were less than 20 tons per acre.

Alfalfa and pasture were good crops to grow to control NO_3 leaching, if there was adequate land to dispose of manure. Without adequate land supply, the same comments about surface nutrient losses apply here.

Reducing Pesticide Loss

Two options should be considered in the Conestoga Headwaters RCWP area to reduce pesticide loads in waterways. Preemergence pesticide treatments incorporated into the soil immediately should be considered. Second, integrated pest management may be effective. To reduce pesticide loads in waterways and increase or maintain income, farmers should employ cultural practices and plant varieties that inhibit certain pests; monitor pest populations and apply control measures only if plant injury appears to exceed the cost of the control measure; and employ chemical controls after cultural, physical, and other measures have been eliminated as economical solutions to the problem.

CONCLUSIONS

No-till appeared effective for reducing all forms of nonpoint source pollution, at minimal cost to farmers and Government, and should be considered throughout the Conestoga Headwaters RCWP project area. No-till was as effective as all other individual soil-conservation BMPs applied to the field for controlling each component of agricultural pollution. In cases where no-till is not acceptable to farmers, some method of reduced tillage should be considered. Reduced tillage operations were not as effective as no-till, but were still more effective than conventional tillage practices for controlling runoff.

Contoured terraces, grassed waterways, and other expensive structural practices should be considered for those farms which, after conservation-tillage practices have already been adopted, still do not meet acceptable levels of soil losses. Combining these soil-conservation practices with nutrient and pesticide management can be considered comparable with the resource-management systems being contracted in the RCWP project. However, some of these practices would be discouraged if excessive nutrient loading and NO_3 in groundwater are overriding concerns or if cost-sharing and technical-assistance funds are limited.

Early establishment of winter cover crops could slow runoff, increase infiltration, and take up excess plant nutrients in the fall and early spring when crops are not growing. Fertilizer and pesticide management are also obvious needs to prevent excessive application and movement of the chemicals to water supplies.

All BMPs should be considered only if individual field conditions warrant them--no-till with a winter cover crop and good farm managment may be all that is needed. Again, soil conservation practices may actually worsen the NO_3 problem. No-till in combination with other BMPs may be more effective than reduced tillage because of reducing runoff losses while also reducing leaching losses.

Manure storage appeared partially effective for reducing total nutrient losses. Injection was the best application method for liquid manure if normal loadings of manure were applied to the field.

Alfalfa hay and pasture were excellent controls for all components of agricultural land pollution if adequate land was available to dispose of manure. Grass hay was not evaluated, but could be considered an alternative to N-fixing alfalfa. Corn following plowdown of alfalfa displayed higher percolate losses of NO_3 than it did for nonleguminous residues. High-yielding grasses that take up substantial N could be recommended for farmers who have severe manure problems.

On many farms, excess manure is so great that it cannot be disposed of without seriously degrading the water quality. The answers for these farm operators are not attractive: the manure must be hauled off the farm to another site, or the number of animals on the farm must be reduced.

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APPENDIX A: MODELING ASSUMPTIONS

Rainfall Data

We used time-intensity rainfall data to model field losses with the CREAMS model. Precipitation, recorded at a 5-minute frequency, allowed the use of the CREAMS breakpoint rainfall option. This option better predicted infiltration and runoff than did the average daily rainfall option, and estimates of soil and chemical losses were also more reliable.

Three years of data represented normal (1970, 41.5 inches), below normal (1971, 36.9 inches), and above normal (1977, 46.6 inches) annual precipitation. Each of the yearly cropping activities was modeled for each year of precipitation data. The average losses were then estimated as annual soil and chemical losses. Three years of precipitation data may not determine longrun average losses, but it was possible to inexpensively obtain estimates of losses for typical years (compared with the costs of simulating 10 to 20 years of data). Assumptions about the execution of tillage practices, planting, and other management practices were the same for all 3 years. Thus, the relative differences in losses among practices did not differ greatly according to the amount of precipitation; only the magnitude of the losses changed significantly.

Field Assumptions

Average uniform slopes of 2, 5, and 9 percent were modeled to represent Duffield silt loam A, B, and C slopes (Soil Conservation Service classification). A 1.5-percent slope was selected to model poorly drained pastureland adjacent to streams (Lindside silt loam, 0- to 3-percent slopes).

The Duffield series consists of deep, well-drained, and highly productive soils with high moisture-holding capacity. In the underlying limestone, many fractures and caves provide good internal drainage. These and other associated limestone soils are among the most fertile and intensively farmed soils in the RCWP project area. The Duffield-Hagerstown soil association constitutes about half of the farmland.

The Lindside silt loam, 1.5-percent slope, was modeled to determine near-stream pasture losses. Lindside soils dominated areas adjacent to stream channels. They are deep, moderately well drained to somewhat poorly drained, and fertile. Lindside soils develop from alluvium deposited by larger streams or from material (mostly Duffield or Hagerstown topsoils) washed from nearby slopes into areas around the base of slopes. Limestone underlies these soils, making them high in natural fertility; but they are too poorly drained to be used for crops in flood-plain areas.

Stream Delivery

Overland-flow losses were estimated at the edge of the field. Stream delivery was not estimated. Sediment lost from a field was considered to be delivered in a gully or channel or suspended in runoff and delivered to the downslope field, along with the chemicals dissolved in runoff or attached to sediment particles. Losses of NO_3 leached through the root zone were assumed to be delivered to groundwater resources because the CREAMS model cannot determine subsurface return flow to streams or otherwise diverted flows.

Sediment delivery from live sources to streams was 20 percent of gross erosion in Lancaster County. In critical areas where there are high runoff and erosion rates and where erosion occurs in proximity to streams, this delivery ratio could be considerably greater. Sediment-associated nutrients and other chemicals could exhibit delivery ratios similar to sediment, while chemicals dissolved in runoff would have somewhat greater stream delivery. While this study did not estimate delivery ratios for pollutants, they were typically 0.2 to 0.5, with greater delivery in areas adjacent to streams. Therefore, the Conestoga Headwaters watershed was a significant contributor of soil and chemicals to streams, given the intensity of crop and livestock production.

Width of Strips

One width of strips for stripcropping and terrace systems was chosen. The width of strips in stripcropping systems usually ranged between 80 and 120 feet, depending on slope, field measurements, and soil. Terraces typically ranged between 120 to 300 feet in width. To model the two practices jointly (all BMPs combination of practices) without influencing the interpretation of CREAMS estimates for either practice, the common width of 120 feet was selected for all modeling scenarios.

By performing sensitivity analyses for different slope lengths, we found overestimation of surface-runoff losses and underestimation of NO_3 leaching for stripcropping (modeled with the strips wider in width than in reality) was slight, less than 5 percent in all cases. Likewise, underestimation of runoff and overestimation of percolation from terraces (modeled with widths narrower than in reality) were less significant than for stripcropping. Therefore, results from the modeled activities should not be biased significantly. The width of most strips and terraces in the RCWP project area were relatively close to the assumed 120 feet.

Adjustment for Snowmelt

The hydrology component's computer code was altered to correct a double accounting problem, which led to unreasonably low estimates of runoff from snowmelt. Snowmelt was distributed for days when snow existed and temperatures allowed: midnight to 6 a.m. (5 percent), 6 a.m. to noon (25 percent), noon to 6 p.m. (60 percent), and 6 p.m. to midnight (10 percent). This time distribution was computed from runoff data collected from USDA-ARS research watersheds in Vermont. Daily runoff, peak-runoff rate, and the erosivity index for days when snowmelt occurred were calculated and incorporated (2).

Winter Cover

Winter cover was modeled after the harvest of corn silage. Winter rye was assumed to be planted in late September, and produced the residue necessary for effective conservation tillage (2,000 pounds per acre as modeled). Management of corn grain and hay residues was considered adequate runoff protection following the harvest of those crops, and no winter cover was modeled. Parameters for the effects of winter cover on hydrologic flow and erosion were estimated from (3).

Modeling Plant Nutrients

Table A1 shows the nutrient requirements of the crops modeled. Applications of N and P_2O_5 represented the minimum levels of nutrients modeled from combined animal manure, commercial fertilizer, and legumes. Animal manure and legume nutrients

depended on the crop residue and level of manure application modeled. Commercial fertilizer, plowed under for conventional and reduced tillage and topdressed for no-till, was added until minimum fertilization levels were satisfied for all crops. Part of the commercial-fertilizer requirements could be met by starter-fertilizer applications, modeled as band placed at seed depth under all practices.

Manure applications were modeled using the nutrient constituents of the manure. Therefore, the N volatilization, barnyard, and storage losses were deducted from the manure-nutrient values. Most of these losses were ammonia-N volatilization. Table A2 shows nutrient losses from barnyard runoff, storage, transfer, and field application (N volatilization) of manure, as modeled. The pounds of N, P_2O_5, and K_2O per ton of mixed manure as voided are also shown in table A2. Mixed animal-manure production was determined for a subwatershed that was the priority-1 critical area in the RCWP project. The primary animal operations contributing to loading in the subwatershed were cattle, swine, and poultry.

Animal-Waste Management

Animal-manure storage and application were modeled for three storage periods and three methods of field application. The storage periods were a few days (daily spreading), 6 months, and 12 months. Semi-solid/solid or liquid storage was considered, depending on the method of application. The application methods included surface spreading without incorporation (daily spread), or with incorporation using a plow (plowdown), and liquid-manure injection. Daily spreading of manure was incorporated for the spring application only when corn or alfalfa land was prepared for seeding. For 6-month storage using plowdown, the fall application was assumed to be surface spread without incorporation--no fall plowing was modeled.

Daily manure-spreading systems involved field spreading every 1 to several days. Manure was assumed to be stacked, either in a barnyard or beneath an open shed, during runoff events and periods when snow cover exists. (Some farmers stack manure in their fields for extended periods of time. RCWP cost sharing and technical assistance should prevent such practices in the future.) The limited amount of manure produced daily by the relatively small animal operations (which typify the RCWP project area) also make it desirable to stack manure for some time until a full load of manure can be spread.

Modeling field losses with CREAMS did not account for the barnyard and storage losses of nutrients to surface and subsurface waters. Significant runoff losses from unimproved barnyards and stacks of manure can occur if they are exposed to surface runoff waters. These circumstances commonly exist on farms with daily-spreading systems. Manure-management plans and storage structures generally require barn and barnyard improvements, which also can be provided on farms with daily-spreading systems. The same high level of manure management was assumed for daily-spreading and storage systems to prevent barnyard runoff. While this assumption may not be realistic, it did not affect the comparison of field losses between daily-spreading and storage systems.

Manure applications from daily-spreading systems were modeled immediately before corn planting and after harvesting. Additional applications were modeled in late fall and late winter as necessary to dispose of manure. It was assumed that a specific point in any field was manured no more than four times a year. Assuming that manure was applied at the maximum application rate modeled, four applications of 10 tons per acre (or 40 tons) were made annually. Manure applied to alfalfa was modeled as after the last cut in established meadows, and before planting for

Table A1--Crop nutrient requirements for the Conestoga Headwaters RCWP project area

Crop	Standing yield	N	P_2O_5	K_2O*
	Yield	-- Pounds per acre --		
Corn grain	120 bushels	120	30	100
Corn silage	20 tons	140	32	112
Alfalfa hay:				
Establishment year	2.9 tons	20	20	105
Established meadow	4.4 tons	0	20	105
Grass pasture	2.5 tons	50	50	50

* CREAMS does not model potash, K_2O. It is shown here for illustrative purposes, and the costs of commercial potash fertilizer will be incorporated in future economic analyses of the RCWP project.

Source: (6).

newly-seeded alfalfa. Pasture was modeled as being manured during the spring and summer growing season when other land was not available for disposal.

For 6-month storage systems, manure was modeled as applied prior to planting and crop growth, and after fall harvest for both corn and alfalfa. Pasture was also modeled as manured in both spring and fall. For 12-month storage systems, manure applications were modeled as spring applications for all crops, except established alfalfa (modeled as being manured in the fall after the last cutting), so that nutrients would be available during the crop's growth period.

Table A2--Nutrient content of mixed manure and losses of nutrients associated with barnyard runoff, storage, transfer, and application of manure

Nutrient content	N	P_2O_5	K_2O
		Pounds per ton	
Nurients in mixed manure as voided*	11.0	5.5	6.5
Losses of nutrients resulting from barnyard runoff, storage, transfer, and application of manure**:		Percent loss	
Daily spread	50	25	15
6-month storage--			
Spring plowdown	30	25	15
Spring topdress	40	25	15
Fall topdress	50	25	15
Spring injection	23	25	15
Fall injection	44	25	15
12-month storage--			
Spring plowdown	30	25	15
Spring topdress	40	25	15
Spring injection	23	25	15

* Calculated from the weighted average of manures (cattle, swine, poultry, horses, and mules) produced in the Little Conestoga Creek subwatershed, Lancaster County, Pa.

** Includes losses from barnyard runoff, transfers to and from storage, storage (mostly N volatilization), and field application (mostly N volatilization). Does not include losses in surface runoff or soil percolate, which are calculated by the CREAMS model. Losses are taken from (4).

APPENDIX B: CREAMS ESTIMATES OF NUTRIENT LOSSES

Table B1-- CREAMS Estimates of Nutrient Losses (lbs/acre) for Corn Grain Following Alfalfa on a 2 Percent Slope

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs	40	Daily	14.54	13.87	61.33	28.41	89.73	2.33	7.21	9.54
Reduced Till	40	Daily	12.88	4.66	62.21	17.54	79.75	2.08	2.43	4.51
All BMPs	40	Daily	12.84	4.44	62.91	17.28	80.19	2.14	2.31	4.45
No-Till	40	Daily	17.01	1.99	54.85	19.00	73.85	3.30	1.04	4.33
No BMPs-Plowdown	40	6-Month	11.39	13.87	69.33	25.26	94.59	0.62	7.21	7.83
Reduced Till-Plowdown	40	6-Month	10.05	4.66	70.93	14.71	85.64	0.56	2.43	2.99
All BMPs-Plowdown	40	6-Month	9.75	4.44	71.26	14.19	85.45	0.59	2.31	2.90
No-Till-Topdress	40	6-Month	14.01	1.99	57.59	16.00	73.58	1.57	1.04	2.61
No BMPs-Plowdown	40	12-Month	14.32	13.87	84.59	28.19	112.77	0.24	7.21	7.45
Reduced Till-Plowdown	40	12-Month	12.65	4.66	88.26	17.31	105.58	0.24	2.43	2.66
All BMPs-Plowdown	40	12-Month	12.03	4.44	89.77	16.47	106.24	0.25	2.31	2.56
No-Till-Topdress	40	12-Month	17.90	1.99	62.56	19.89	82.46	1.36	1.04	2.40
No BMPs-Injection	40	12-Month	18.65	13.87	99.74	35.52	132.26	0.31	7.21	7.52
Reduced Till-Injection	40	12-Month	16.20	4.66	101.31	20.86	122.17	0.30	2.43	2.73
All BMPs-Injection	40	12-Month	16.06	4.44	97.40	20.50	117.90	0.31	2.31	2.62
No-Till-Injection	40	12-Month	20.82	1.99	96.68	22.81	119.49	1.13	1.04	2.17
No BMPs	30	Daily	8.60	11.09	57.28	19.69	76.97	0.69	5.55	6.24
Reduced Till	30	Daily	7.73	3.73	57.57	11.46	69.03	0.67	1.87	2.53
All BMPs	30	Daily	7.57	3.55	58.05	11.12	69.18	0.68	1.78	2.46
No-Till	30	Daily	10.35	1.59	48.77	11.95	60.72	1.53	0.80	2.32
No BMPs-Plowdown	30	6-Month	9.18	11.09	55.04	20.28	75.32	0.50	5.55	6.05
Reduced Till-Plowdown	30	6-Month	8.06	3.73	55.58	11.80	67.38	0.46	1.87	2.33
All BMPs-Plowdown	30	6-Month	7.85	3.55	56.08	11.41	67.48	0.48	1.78	2.26
No-Till-Topdress	30	6-Month	10.97	1.59	41.95	12.56	54.52	1.39	0.80	2.19
No BMPs-Plowdown	30	12-Month	10.56	11.09	57.59	21.66	79.24	0.21	5.55	5.76
Reduced Till-Plowdown	30	12-Month	9.33	3.73	60.64	13.06	73.69	0.21	1.87	2.08
All BMPs-Plowdown	30	12-Month	8.87	3.55	62.00	12.42	74.42	0.22	1.78	2.00
No-Till-Topdress	30	12-Month	13.49	1.59	41.20	15.08	56.28	1.24	0.80	2.03
No BMPs-Injection	30	12-Month	13.66	11.09	68.98	24.75	93.73	0.27	5.55	5.82
Reduced Till-Injection	30	12-Month	11.86	3.73	70.44	15.59	86.03	0.26	1.87	2.13
All BMPs-Injection	30	12-Month	11.75	3.55	67.91	15.30	83.21	0.28	1.78	2.06
No-Till-Injection	30	12-Month	15.47	1.59	66.80	17.06	83.86	1.07	0.80	1.87
No BMPs	20	Daily	6.46	8.32	39.20	14.78	53.98	0.49	4.44	4.93
Reduced Till	20	Daily	5.84	2.80	39.81	8.64	48.44	0.49	1.49	1.98
All BMPs	20	Daily	5.69	2.66	40.67	8.36	49.03	0.50	1.42	1.92
No-Till	20	Daily	8.06	1.19	31.20	9.26	40.46	1.27	0.64	1.91
No BMPs-Plowdown	20	6-Month	6.95	8.32	40.49	15.27	55.76	0.39	4.44	4.83
Reduced Till-Plowdown	20	6-Month	6.10	2.80	40.87	8.90	49.77	0.37	1.49	1.86
All BMPs-Plowdown	20	6-Month	5.95	2.66	41.28	8.61	49.90	0.38	1.42	1.80
No-Till-Topdress	20	6-Month	8.41	1.19	30.47	9.60	40.08	1.19	0.64	1.83
No BMPs-Plowdown	20	12-Month	7.14	8.32	33.46	15.46	48.92	0.20	4.44	4.64
Reduced Till-Plowdown	20	12-Month	6.24	2.80	34.78	9.04	43.82	0.20	1.49	1.69
All BMPs-Plowdown	20	12-Month	6.01	2.66	36.12	8.67	44.79	0.21	1.42	1.63
No-Till-Topdress	20	12-Month	8.98	1.19	18.69	10.17	28.86	1.09	0.64	1.72
No BMPs-Injection	20	12-Month	8.53	8.32	37.32	16.85	54.17	0.25	4.44	4.69
Reduced Till-Injection	20	12-Month	7.43	2.80	38.71	10.23	48.94	0.24	1.49	1.73
All BMPs-Injection	20	12-Month	7.41	2.66	37.65	10.07	47.72	0.25	1.42	1.67
No-Till-Injection	20	12-Month	9.92	1.19	36.00	11.11	47.11	0.96	0.64	1.60

Table B1 -- (Continued.)

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs	15	Daily	5.46	5.55	32.24	11.01	43.25	0.43	2.77	3.20
Reduced Till	15	Daily	4.92	1.87	32.71	6.79	39.50	0.44	0.93	1.37
All BMPs	15	Daily	4.81	1.78	33.42	6.58	40.00	0.45	0.89	1.34
No-Till	15	Daily	6.87	0.80	25.27	7.66	32.94	1.10	0.40	1.50
No BMPs-Plowdown	15	6-Month	5.83	5.55	33.21	11.38	44.59	0.35	2.77	3.13
Reduced Till-Plowdown	15	6-Month	5.13	1.87	33.51	6.99	40.50	0.35	0.93	1.28
All BMPs-Plowdown	15	6-Month	5.00	1.78	33.89	6.77	40.66	0.36	0.89	1.25
No-Till-Topdress	15	6-Month	7.13	0.80	24.73	7.93	32.65	1.04	0.40	1.44
No BMPs-Plowdown	15	12-Month	5.98	5.55	27.94	11.52	39.47	0.19	2.77	2.96
Reduced Till-Plowdown	15	12-Month	5.23	1.87	28.95	7.09	36.05	0.19	0.93	1.12
All BMPs-Plowdown	15	12-Month	5.04	1.78	30.02	6.82	36.84	0.20	0.89	1.09
No-Till-Topdress	15	12-Month	7.53	0.80	15.62	8.33	23.95	0.92	0.40	1.31
No BMPs-Injection	15	12-Month	6.03	5.55	36.04	11.58	47.62	0.23	2.77	3.00
Reduced Till-Injection	15	12-Month	5.54	1.87	23.45	7.41	30.86	0.22	0.93	1.15
All BMPs-Injection	15	12-Month	5.59	1.78	23.54	7.37	30.91	0.23	0.89	1.12
No-Till-Injection	15	12-Month	7.50	0.80	20.90	8.30	29.20	0.86	0.40	1.26
No BMPs	10	Daily	4.61	5.55	25.57	10.16	35.73	0.35	2.77	3.12
Reduced Till	10	Daily	4.14	1.87	25.94	6.01	31.95	0.37	0.93	1.30
All BMPs	10	Daily	4.04	1.78	26.53	5.82	32.35	0.37	0.89	1.26
No-Till	10	Daily	5.83	0.80	19.62	6.62	26.24	1.00	0.40	1.40
No BMPs-Plowdown	10	6-Month	4.72	5.55	25.94	10.27	36.20	0.30	2.77	3.08
Reduced Till-Plowdown	10	6-Month	4.15	1.87	26.16	6.01	32.17	0.30	0.93	1.24
All BMPs-Plowdown	10	6-Month	4.05	1.78	26.50	5.82	32.32	0.32	0.89	1.21
No-Till-Topdress	10	6-Month	5.85	0.80	18.99	6.65	25.63	0.96	0.40	1.36
No BMPs-Plowdown	10	12-Month	4.81	5.55	22.42	10.36	32.78	0.21	2.77	2.98
Reduced Till-Plowdown	10	12-Month	4.21	1.87	23.11	6.08	29.19	0.22	0.93	1.16
All BMPs-Plowdown	10	12-Month	4.08	1.78	23.91	5.85	29.77	0.23	0.89	1.12
No-Till-Topdress	10	12-Month	6.12	0.80	12.92	6.92	19.84	0.91	0.40	1.31
No BMPs-Injection	10	12-Month	5.12	5.55	17.96	10.67	28.63	0.25	2.77	3.02
Reduced Till-Injection	10	12-Month	4.47	1.87	18.62	6.34	24.96	0.24	0.93	1.17
All BMPs-Injection	10	12-Month	4.48	1.78	18.68	6.26	24.94	0.25	0.89	1.14
No-Till-Injection	10	12-Month	5.99	0.80	12.72	6.79	19.51	0.89	0.40	1.29

Table B2 -- CREAMS Estimates of Nutrient Losses (lbs/acre) for Corn Grain Following Corn Grain on a 2 Percent Slope

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs	40	Daily	16.38	17.64	52.86	34.03	86.88	3.24	9.17	12.42
Reduced Till	40	Daily	11.27	7.91	55.06	19.17	74.23	2.08	4.11	6.19
All BMPs	40	Daily	14.94	5.50	53.76	20.44	74.20	3.02	2.86	5.88
No-Till	40	Daily	17.90	4.67	48.04	22.57	70.61	4.36	2.43	6.78
No BMPs-Plowdown	40	6-Month	10.67	17.64	63.31	28.31	91.63	0.65	9.17	9.82
Reduced Till-Plowdown	40	6-Month	8.24	7.91	63.94	16.15	80.08	0.56	4.11	4.68
All BMPs-Plowdown	40	6-Month	9.39	5.50	63.79	14.89	78.68	0.62	2.86	3.48
No-Till-Topdress	40	6-Month	12.25	4.67	50.09	16.92	67.01	1.74	2.43	4.17
No BMPs-Plowdown	40	12-Month	11.42	17.64	65.22	29.06	94.28	0.26	9.17	9.44
Reduced Till-Plowdown	40	12-Month	9.51	7.91	69.24	17.42	86.66	0.24	4.11	4.35
All BMPs-Plowdown	40	12-Month	9.97	5.50	70.87	15.47	86.35	0.27	2.86	3.13
No-Till-Topdress	40	12-Month	14.49	4.67	40.61	19.15	59.77	1.59	2.43	4.02
No BMPs-Injection	40	12-Month	17.42	17.64	78.41	35.06	113.47	0.32	9.17	9.49
Reduced Till-Injection	40	12-Month	13.78	7.91	80.09	21.69	101.78	0.29	4.11	4.40
All BMPs-Injection	40	12-Month	15.14	5.50	76.06	20.64	96.70	0.31	2.86	3.17
No-Till-Injection	40	12-Month	18.35	4.67	77.14	23.02	100.16	1.15	2.43	3.58
No BMPs	30	Daily	10.44	14.11	48.81	24.55	73.37	1.60	7.06	8.66
Reduced Till	30	Daily	6.13	6.33	50.42	12.45	62.87	0.67	3.16	3.83
All BMPs	30	Daily	9.66	4.40	48.90	14.06	62.96	1.56	2.20	3.76
No-Till	30	Daily	11.52	3.73	44.32	15.25	59.57	2.59	1.87	4.45
No BMPs-Plowdown	30	6-Month	8.27	14.11	48.61	22.39	71.00	0.52	7.06	7.58
Reduced Till-Plowdown	30	6-Month	6.37	6.33	48.99	12.70	61.69	0.46	3.16	3.62
All BMPs-Plowdown	30	6-Month	7.30	4.40	48.82	11.70	60.53	0.50	2.20	2.70
No-Till-Topdress	30	6-Month	9.46	3.73	38.72	13.19	51.91	1.54	1.87	3.41
No BMPs-Plowdown	30	12-Month	7.62	14.11	38.83	21.73	60.56	0.24	7.06	7.29
Reduced Till-Plowdown	30	12-Month	6.43	6.33	40.21	12.75	52.96	0.21	3.16	3.38
All BMPs-Plowdown	30	12-Month	6.57	4.40	41.97	10.98	52.95	0.24	2.20	2.45
No-Till-Topdress	30	12-Month	9.68	3.73	19.55	13.42	32.96	1.43	1.87	3.30
No BMPs-Injection	30	12-Month	11.77	14.11	47.13	25.88	73.01	0.28	7.06	7.34
Reduced Till-Injection	30	12-Month	9.46	6.33	48.38	15.79	64.17	0.26	3.16	3.42
All BMPs-Injection	30	12-Month	10.22	4.40	46.10	14.62	60.72	0.27	2.20	2.47
No-Till-Injection	30	12-Month	12.42	3.73	46.35	16.15	62.50	1.09	1.87	2.96
No BMPs	20	Daily	8.16	10.59	32.54	18.75	51.29	1.40	5.65	7.04
Reduced Till	20	Daily	4.58	4.74	34.33	9.32	43.65	0.49	2.53	3.02
All BMPs	20	Daily	7.61	3.30	33.56	10.91	44.47	1.37	1.76	3.14
No-Till	20	Daily	9.36	2.80	27.11	12.16	39.26	2.32	1.49	3.82
No BMPs-Plowdown	20	6-Month	5.80	10.59	33.42	16.39	49.81	0.41	5.65	6.06
Reduced Till-Plowdown	20	6-Month	4.44	4.74	33.55	9.19	42.74	0.37	2.53	2.90
All BMPs-Plowdown	20	6-Month	5.14	3.30	33.35	8.44	41.79	0.40	1.76	2.16
No-Till-Topdress	20	6-Month	6.80	2.80	27.24	9.60	36.84	1.32	1.49	2.82
No BMPs-Plowdown	20	12-Month	5.35	10.59	26.88	15.94	42.82	0.22	5.65	5.87
Reduced Till-Plowdown	20	12-Month	4.48	4.74	27.66	9.22	36.88	0.20	2.53	2.73
All BMPs-Plowdown	20	12-Month	4.65	3.30	28.76	7.95	36.71	0.23	1.76	1.99
No-Till-Topdress	20	12-Month	6.73	2.80	14.07	9.53	23.60	1.25	1.49	2.74
No BMPs-Injection	20	12-Month	6.38	10.59	17.15	16.97	34.12	0.26	5.65	5.91
Reduced Till-Injection	20	12-Month	5.37	4.74	18.64	10.11	28.75	0.24	2.53	2.77
All BMPs-Injection	20	12-Month	5.69	3.30	18.56	8.99	27.55	0.25	1.76	2.01
No-Till-Injection	20	12-Month	6.68	2.80	16.29	9.48	25.77	1.01	1.49	2.50

Table B2-- (Continued.)

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs	15	Daily	7.21	7.06	28.63	14.26	42.89	1.11	3.53	4.64
Reduced Till	15	Daily	4.35	3.16	30.11	7.51	37.62	0.44	1.58	2.02
All BMPs	15	Daily	6.67	2.20	29.68	8.87	38.55	1.11	1.10	2.21
No-Till	15	Daily	8.41	1.87	23.10	10.28	33.38	1.90	0.93	2.83
No BMPs-Plowdown	15	6-Month	5.33	7.06	28.75	12.39	41.14	0.37	3.53	3.90
Reduced Till-Plowdown	15	6-Month	4.16	3.16	28.96	7.32	36.28	0.35	1.58	1.93
All BMPs-Plowdown	15	6-Month	4.73	2.20	28.93	6.93	35.86	0.38	1.10	1.48
No-Till-Topdress	15	6-Month	6.50	1.87	23.20	8.37	31.56	1.15	0.93	2.08
No BMPs-Plowdown	15	12-Month	4.23	7.06	20.93	11.29	32.22	0.21	3.53	3.74
Reduced Till-Plowdown	15	12-Month	3.51	3.16	21.42	6.67	28.09	0.19	1.58	1.77
All BMPs-Plowdown	15	12-Month	3.69	2.20	22.18	5.90	28.07	0.22	1.10	1.32
No-Till-Topdress	15	12-Month	5.69	1.87	12.05	7.55	19.60	1.05	0.93	1.98
No BMPs-Injection	15	12-Month	4.99	7.06	13.62	12.05	25.67	0.23	3.53	3.76
Reduced Till-Injection	15	12-Month	4.17	3.16	14.63	7.33	21.96	0.21	1.58	1.79
All BMPs-Injection	15	12-Month	4.48	2.20	14.50	6.68	21.18	0.22	1.10	1.32
No-Till-Injection	15	12-Month	5.23	1.87	13.01	7.10	20.11	0.89	0.93	1.82
No BMPs	10	Daily	6.18	7.06	25.45	13.24	38.69	0.81	3.53	4.34
Reduced Till	10	Daily	4.05	3.16	26.59	7.21	33.81	0.37	1.58	1.95
All BMPs	10	Daily	5.65	2.20	26.55	7.85	34.40	0.82	1.10	1.92
No-Till	10	Daily	7.51	1.87	19.11	9.38	28.49	1.56	0.93	2.49
No BMPs-Plowdown	10	6-Month	4.93	7.06	25.53	11.99	37.52	0.32	3.53	3.85
Reduced Till-Plowdown	10	6-Month	3.92	3.16	25.83	7.08	32.91	0.30	1.58	1.89
All BMPs-Plowdown	10	6-Month	4.36	2.20	26.05	6.56	32.61	0.34	1.10	1.44
No-Till-Topdress	10	6-Month	6.24	1.87	19.17	8.11	27.28	1.06	0.93	1.99
No BMPs-Plowdown	10	12-Month	4.15	7.06	19.33	11.21	30.54	0.23	3.53	3.76
Reduced Till-Plowdown	10	12-Month	3.45	3.16	19.81	6.61	26.42	0.22	1.58	1.80
All BMPs-Plowdown	10	12-Month	3.64	2.20	20.50	5.84	26.34	0.25	1.10	1.35
No-Till-Topdress	10	12-Month	5.67	1.87	11.73	7.53	19.27	1.03	0.93	1.96
No BMPs-Injection	10	12-Month	4.38	7.06	12.67	11.44	24.11	0.24	3.53	3.77
Reduced Till-Injection	10	12-Month	3.66	3.16	13.19	6.82	20.01	0.23	1.58	1.81
All BMPs-Injection	10	12-Month	3.91	2.20	13.10	6.11	19.21	0.26	1.10	1.36
No-Till-Injection	10	12-Month	4.75	1.87	10.42	6.62	17.04	0.92	0.93	1.85

Table B3 -- CREAMS Estimates of Nutrient Losses (lbs/acre) for Corn Grain Following Corn Silage on a 2 Percent Slope

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs	40	Daily	16.38	20.41	52.86	36.79	89.65	3.24	10.61	13.86
Reduced Till	40	Daily	11.27	11.82	55.06	23.08	78.14	2.08	6.14	8.23
All BMPs	40	Daily	11.35	8.35	54.46	19.70	74.16	2.14	4.34	6.48
No-Till	40	Daily	14.09	7.30	48.81	21.40	70.20	3.30	3.80	7.09
No BMPs-Plowdown	40	6-Month	10.67	20.41	63.31	31.08	94.39	0.65	10.61	11.26
Reduced Till-Plowdown	40	6-Month	8.24	11.82	63.94	20.06	83.99	0.56	6.14	6.71
All BMPs-Plowdown	40	6-Month	8.19	8.35	62.50	16.54	79.04	0.59	4.34	4.93
No-Till-Topdress	40	6-Month	10.82	7.30	49.40	18.12	67.52	1.57	3.80	5.37
No BMPs-Plowdown	40	12-Month	11.42	20.41	65.22	31.83	97.05	0.26	10.61	10.88
Reduced Till-Plowdown	40	12-Month	9.51	11.82	69.24	21.33	90.57	0.24	6.14	6.38
All BMPs-Plowdown	40	12-Month	9.46	8.35	70.14	17.81	87.94	0.25	4.34	4.59
No-Till-Topdress	40	12-Month	13.73	7.30	43.68	21.04	64.72	1.36	3.80	5.16
No BMPs-Injection	40	12-Month	17.42	20.41	78.41	37.83	116.24	0.32	10.61	10.93
Reduced Till-Injection	40	12-Month	13.78	11.82	80.09	25.60	105.69	0.30	6.14	6.44
All BMPs-Injection	40	12-Month	13.88	8.35	77.18	22.23	99.41	0.31	4.34	4.65
No-Till-Injection	40	12-Month	17.12	7.30	78.55	24.42	102.97	1.12	3.80	4.92
No BMPs	30	Daily	10.44	16.33	48.81	26.76	75.58	1.60	8.16	9.77
Reduced Till	30	Daily	6.13	9.45	50.42	15.58	66.00	0.67	4.73	5.39
All BMPs	30	Daily	6.09	6.68	49.60	12.77	62.37	0.68	3.34	4.02
No-Till	30	Daily	7.72	5.84	45.10	13.56	58.67	1.53	2.92	4.45
No BMPs-Plowdown	30	6-Month	8.27	16.33	48.61	24.60	73.21	0.52	8.16	8.69
Reduced Till-Plowdown	30	6-Month	6.37	9.45	48.99	15.82	64.82	0.46	4.73	5.19
All BMPs-Plowdown	30	6-Month	6.35	6.68	47.90	13.03	60.93	0.48	3.34	3.82
No-Till-Topdress	30	6-Month	8.35	5.84	38.21	14.19	52.40	1.39	2.92	4.31
No BMPs-Plowdown	30	12-Month	7.62	16.33	38.83	23.94	62.78	0.24	8.16	8.40
Reduced Till-Plowdown	30	12-Month	6.43	9.45	40.21	15.88	56.09	0.21	4.73	4.94
All BMPs-Plowdown	30	12-Month	6.48	6.68	41.74	13.16	54.90	0.22	3.34	3.56
No-Till-Topdress	30	12-Month	9.38	5.84	22.11	15.22	37.33	1.24	2.92	4.16
No BMPs-Injection	30	12-Month	11.77	16.33	47.13	28.10	75.23	0.28	8.16	8.44
Reduced Till-Injection	30	12-Month	9.46	9.45	48.38	18.91	67.29	0.26	4.73	4.99
All BMPs-Injection	30	12-Month	9.59	6.68	47.44	16.27	63.71	0.27	3.34	3.61
No-Till-Injection	30	12-Month	11.85	5.84	48.28	17.69	65.97	1.07	2.92	3.99
No BMPs	20	Daily	8.16	12.25	32.54	20.40	52.95	1.40	6.53	7.93
Reduced Till	20	Daily	4.58	7.09	34.33	11.67	46.00	0.49	3.78	4.27
All BMPs	20	Daily	4.57	5.01	34.33	9.58	43.91	0.50	2.67	3.17
No-Till	20	Daily	6.08	4.38	28.28	10.46	38.74	1.27	2.34	3.61
No BMPs-Plowdown	20	6-Month	5.80	12.25	33.42	18.05	51.46	0.41	6.53	6.94
Reduced Till-Plowdown	20	6-Month	4.44	7.09	33.55	11.53	45.08	0.37	3.78	4.15
All BMPs-Plowdown	20	6-Month	4.45	5.01	32.79	9.46	42.25	0.38	2.67	3.05
No-Till-Topdress	20	6-Month	6.02	4.38	26.94	10.40	37.34	1.19	2.34	3.53
No BMPs-Plowdown	20	12-Month	5.35	12.25	26.88	17.60	44.48	0.22	6.53	6.75
Reduced Till-Plowdown	20	12-Month	4.48	7.09	27.66	11.57	39.23	0.20	3.78	3.98
All BMPs-Plowdown	20	12-Month	4.48	5.01	27.82	9.49	37.32	0.21	2.67	2.88
No-Till-Topdress	20	12-Month	6.37	4.38	14.15	10.75	24.90	1.09	2.34	3.42
No BMPs-Injection	20	12-Month	6.38	12.25	17.15	18.63	35.78	0.26	6.53	6.79
Reduced Till-Injection	20	12-Month	5.37	7.09	18.64	12.46	31.10	0.24	3.78	4.02
All BMPs-Injection	20	12-Month	5.52	5.01	18.70	10.53	29.23	0.25	2.67	2.92
No-Till-Injection	20	12-Month	6.58	4.38	16.93	10.96	27.89	0.96	2.34	3.30

Table B3 -- (Continued.)

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs	15	Daily	7.21	8.16	28.63	15.37	44.00	1.11	4.08	5.19
Reduced Till	15	Daily	4.35	4.73	30.11	9.08	39.19	0.44	2.36	2.80
All BMPs	15	Daily	4.35	3.34	30.17	7.69	37.86	0.45	1.67	2.12
No-Till	15	Daily	5.90	2.92	24.01	8.82	32.83	1.10	1.46	2.56
No BMPs-Plowdown	15	6-Month	5.33	8.16	28.75	13.50	42.25	0.37	4.08	4.45
Reduced Till-Plowdown	15	6-Month	4.16	4.73	28.96	8.89	37.84	0.35	2.36	2.71
All BMPs-Plowdown	15	6-Month	4.17	3.34	28.45	7.51	35.96	0.36	1.67	2.03
No-Till-Topdress	15	6-Month	5.85	2.92	23.00	8.77	31.77	1.04	1.46	2.50
No BMPs-Plowdown	15	12-Month	4.23	8.16	20.93	12.39	33.32	0.21	4.08	4.29
Reduced Till-Plowdown	15	12-Month	3.51	4.73	21.42	8.23	29.65	0.19	2.36	2.55
All BMPs-Plowdown	15	12-Month	3.53	3.34	21.52	6.87	28.39	0.20	1.67	1.87
No-Till-Topdress	15	12-Month	5.37	2.92	12.13	8.29	20.42	0.92	1.46	2.38
No BMPs-Injection	15	12-Month	4.99	8.16	13.62	13.15	26.77	0.23	4.08	4.31
Reduced Till-Injection	15	12-Month	4.17	4.73	14.63	8.90	23.53	0.21	2.36	2.57
All BMPs-Injection	15	12-Month	4.31	3.34	14.65	7.65	22.30	0.22	1.67	1.89
No-Till-Injection	15	12-Month	5.09	2.92	13.07	8.01	21.08	0.86	1.46	2.32
No BMPs	10	Daily	6.18	8.16	25.45	14.34	39.79	0.81	4.08	4.89
Reduced Till	10	Daily	4.05	4.73	26.59	8.78	35.37	0.37	2.36	2.73
All BMPs	10	Daily	4.06	3.34	26.68	7.39	34.08	0.37	1.67	2.04
No-Till	10	Daily	5.74	2.92	19.75	8.66	28.41	1.00	1.46	2.46
No BMPs-Plowdown	10	6-Month	4.93	8.16	25.53	13.10	38.63	0.32	4.08	4.40
Reduced Till-Plowdown	10	6-Month	3.92	4.73	25.83	8.65	34.47	0.30	2.36	2.67
All BMPs-Plowdown	10	6-Month	3.94	3.34	25.53	7.28	32.81	0.32	1.67	1.99
No-Till-Topdress	10	6-Month	5.71	2.92	19.08	8.63	27.71	0.96	1.46	2.42
No BMPs-Plowdown	10	12-Month	4.15	8.16	19.33	12.32	31.65	0.23	4.08	4.31
Reduced Till-Plowdown	10	12-Month	3.45	4.73	19.81	8.18	27.99	0.22	2.36	2.59
All BMPs-Plowdown	10	12-Month	3.48	3.34	19.94	6.81	26.76	0.23	1.67	1.90
No-Till-Topdress	10	12-Month	5.37	2.92	11.83	8.29	20.12	0.91	1.46	2.37
No BMPs-Injection	10	12-Month	4.38	8.16	12.67	12.54	25.21	0.24	4.08	4.32
Reduced Till-Injection	10	12-Month	3.66	4.73	13.19	8.39	21.58	0.23	2.36	2.59
All BMPs-Injection	10	12-Month	3.76	3.34	13.16	7.10	20.26	0.24	1.67	1.91
No-Till-Injection	10	12-Month	4.62	2.92	10.49	7.54	18.03	0.89	1.46	2.35

Table B4 -- CREAMS Estimates of Nutrient Losses (lbs/acre) for Corn Silage Following Alfalfa on a 2 Percent Slope

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs	40	Daily	13.48	17.42	63.76	30.90	94.66	2.15	9.06	11.21
Reduced Till	40	Daily	11.53	7.60	65.97	19.13	85.10	1.79	3.95	5.75
All BMPs	40	Daily	11.31	4.74	67.76	16.04	83.81	1.83	2.46	4.29
No-Till	40	Daily	15.11	3.78	56.25	18.89	75.14	2.93	1.97	4.90
No BMPs-Plowdown	40	6-Month	10.56	17.42	74.36	27.98	102.33	0.56	9.06	9.62
Reduced Till-Plowdown	40	6-Month	8.62	7.60	76.87	16.23	93.10	0.33	3.95	4.28
All BMPs-Plowdown	40	6-Month	8.05	4.74	79.31	12.79	92.10	0.31	2.46	2.78
No-Till-Topdress	40	6-Month	11.65	3.78	59.77	15.43	75.20	1.22	1.97	3.19
No BMPs-Plowdown	40	12-Month	13.29	17.42	75.38	30.71	106.09	0.24	9.06	9.30
Reduced Till-Plowdown	40	12-Month	11.64	7.60	80.11	19.24	99.35	0.23	3.95	4.19
All BMPs-Plowdown	40	12-Month	10.89	4.74	82.53	15.63	98.16	0.24	2.46	2.70
No-Till-Topdress	40	12-Month	16.86	3.78	58.17	20.64	78.81	1.33	1.97	3.29
No BMPs-Injection	40	12-Month	18.17	17.42	93.50	35.59	129.09	0.31	9.06	9.37
Reduced Till-Injection	40	12-Month	15.58	7.60	97.73	23.18	120.91	0.29	3.95	4.24
All BMPs-Injection	40	12-Month	15.10	4.74	96.83	19.84	116.67	0.30	2.46	2.76
No-Till-Injection	40	12-Month	19.93	3.78	95.28	23,71	118.99	1.11	1.97	3.08
No BMPs	30	Daily	7.55	13.93	59.73	21.49	81.22	0.51	6.97	7.48
Reduced Till	30	Daily	6.39	6.08	61.34	12.47	73.81	0.38	3.04	3.42
All BMPs	30	Daily	6.05	3.79	62.89	9.84	72.73	0.37	1.89	2.27
No-Till	30	Daily	8.75	3.02	52.54	11.77	64.31	1.17	1.51	2.68
No BMPs-Plowdown	30	6-Month	8.54	13.93	59.31	22.48	81.79	0.46	6.97	7.42
Reduced Till-Plowdown	30	6-Month	7.01	6.08	61.25	13.09	74.34	0.28	3.04	3.32
All BMPs-Plowdown	30	6-Month	6.56	3.79	63.23	10.35	73.58	0.27	1.89	2.17
No-Till-Topdress	30	6-Month	9.56	3.02	47.43	12.58	60.01	1.12	1.51	2.63
No BMPs-Plowdown	30	12-Month	9.30	13.93	46.86	23.23	70.10	0.22	6.97	7.18
Reduced Till-Plowdown	30	12-Month	8.19	6.08	50.34	14.27	64.61	0.21	3.04	3.25
All BMPs-Plowdown	30	12-Month	7.85	3.79	53.41	11.64	65.05	0.21	1.89	2.11
No-Till-Topdress	30	12-Month	12.39	3.02	34.56	15.42	49.97	1.20	1.51	2.71
No BMPs-Injection	30	12-Month	12.85	13.93	60.34	26.78	87.12	0.28	6.97	7.25
Reduced Till-Injection	30	12-Month	11.05	6.08	63.43	17.13	80.56	0.26	3.04	3.30
All BMPs-Injection	30	12-Month	10.82	3.79	63.43	14.61	78.04	0.27	1.89	2.16
No-Till-Injection	30	12-Month	14.54	3.02	62.40	17.56	79.96	1.06	1.51	2.57
No BMPs	20	Daily	5.69	10.45	39.67	16.15	55.81	0.34	5.57	5.91
Reduced Till	20	Daily	5.06	4.56	40.72	9.62	50.34	0.32	2.43	2.75
All BMPs	20	Daily	4.86	2.84	41.87	7.71	49.57	0.32	1.52	1.83
No-Till	20	Daily	7.24	2.27	32.38	9.51	41.89	1.07	1.21	2.28
No BMPs-Plowdown	20	6-Month	6.45	10.45	43.75	16.91	60.66	0.37	5.57	5.94
Reduced Till-Plowdown	20	6-Month	5.34	4.56	45.08	9.90	54.98	0.25	2.43	2.68
All BMPs-Plowdown	20	6-Month	5.00	2.84	46.58	7.85	54.43	0.24	1.52	1.75
No-Till-Topdress	20	6-Month	7.40	2.27	34.64	9.67	44.31	1.00	1.21	2.21
No BMPs-Plowdown	20	12-Month	6.91	10.45	34.77	17.36	52.13	0.20	5.57	5.78
Reduced Till-Plowdown	20	12-Month	6.02	4.56	36.20	10.58	46.78	0.20	2.43	2.63
All BMPs-Plowdown	20	12-Month	5.74	2.84	37.85	8.58	46.43	0.20	1.52	1.72
No-Till-Topdress	20	12-Month	8.71	2.27	19.95	10.98	30.93	1.05	1.21	2.26
No BMPs-Injection	20	12-Month	7.53	10.45	26.82	17.98	44.80	0.25	5.57	5.82
Reduced Till-Injection	20	12-Month	6.54	4.56	28.84	11.10	39.94	0.24	2.43	2.67
All BMPs-Injection	20	12-Month	6.58	2.84	29.87	9.42	39.29	0.25	1.52	1.77
No-Till-Injection	20	12-Month	8.97	2.27	28.39	11.24	39.63	0.94	1.21	2.15

Table B4 -- (Continued.)

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs	15	Daily	4.84	6.97	32.90	11.81	44.70	0.31	3.48	3.80
Reduced Till	15	Daily	4.29	3.04	33.71	7.33	41.04	0.31	1.52	1.83
All BMPs	15	Daily	4.12	1.89	34.71	6.02	40.73	0.31	0.95	1.26
No-Till	15	Daily	6.20	1.51	26.53	7.72	34.25	0.94	0.76	1.70
No BMPs-Plowdown	15	6-Month	5.41	6.97	35.97	12.38	48.35	0.33	3.48	3.82
Reduced Till-Plowdown	15	6-Month	4.50	3.04	36.99	7.54	44.53	0.26	1.52	1.78
All BMPs-Plowdown	15	6-Month	4.23	1.89	38.25	6.12	44.37	0.25	0.95	1.20
No-Till-Topdress	15	6-Month	6.32	1.51	28.23	7.83	36.06	0.89	0.76	1.65
No BMPs-Plowdown	15	12-Month	5.75	6.97	29.24	12.72	41.96	0.19	3.48	3.68
Reduced Till-Plowdown	15	12-Month	5.01	3.04	30.34	8.05	38.39	0.19	1.52	1.71
All BMPs-Plowdown	15	12-Month	4.78	1.89	31.72	6.67	38.39	0.19	0.95	1.14
No-Till-Topdress	15	12-Month	7.31	1.51	17.22	8.82	26.03	0.89	0.76	1.64
No BMPs-Injection	15	12-Month	6.16	6.97	23.27	13.13	36.40	0.22	3.48	3.70
Reduced Till-Injection	15	12-Month	5.35	3.04	24.79	8.39	33.18	0.21	1.52	1.73
All BMPs-Injection	15	12-Month	5.35	1.89	25.15	7.24	32.39	0.22	0.95	1.17
No-Till-Injection	15	12-Month	7.07	1.51	18.87	8.58	27.45	0.85	0.76	1.61
No BMPs	10	Daily	4.74	6.97	28.72	11.71	40.43	0.28	3.48	3.76
Reduced Till	10	Daily	4.19	3.04	29.52	7.23	36.75	0.28	1.52	1.80
All BMPs	10	Daily	4.02	1.89	30.51	5.92	36.43	0.28	0.95	1.23
No-Till	10	Daily	6.12	1.51	22.32	7.63	29.95	0.89	0.76	1.64
No BMPs-Plowdown	10	6-Month	4.84	6.97	29.44	11.80	41.25	0.29	3.48	3.77
Reduced Till-Plowdown	10	6-Month	4.08	3.04	30.29	7.12	37.42	0.24	1.52	1.77
All BMPs-Plowdown	10	6-Month	3.86	1.89	31.40	5.75	37.15	0.24	0.95	1.19
No-Till-Topdress	10	6-Month	6.00	1.51	23.11	7.51	30.62	0.85	0.76	1.61
No BMPs-Plowdown	10	12-Month	4.60	6.97	23.70	11.56	35.26	0.21	3.48	3.70
Reduced Till-Plowdown	10	12-Month	4.00	3.04	24.47	7.05	31.52	0.22	1.52	1.74
All BMPs-Plowdown	10	12-Month	3.82	1.89	25.57	5.71	31.28	0.22	0.95	1.17
No-Till-Topdress	10	12-Month	6.05	1.51	14.76	7.57	22.33	0.88	0.76	1.63
No BMPs-Injection	10	12-Month	4.93	6.97	19.17	11.90	31.07	0.23	3.48	3.71
Reduced Till-Injection	10	12-Month	4.28	3.04	19.90	7.32	27.22	0.24	1.52	1.76
All BMPs-Injection	10	12-Month	4.25	1.89	20.20	6.14	26.34	0.24	0.95	1.19
No-Till-Injection	10	12-Month	5.82	1.51	14.62	7.33	21.95	0.88	0.76	1.64

Table B5 -- CREAMS Estimates of Nutrient Losses (lbs/acre) for Corn Silage Following Corn Grain on a 2 Percent Slope

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs	40	Daily	13.57	21.37	53.96	34.94	88.90	2.60	11.11	13.71
Reduced Till	40	Daily	9.62	10.57	56.66	20.19	76.85	1.79	5.50	7.29
All BMPs	40	Daily	11.61	6.43	57.12	18.04	75.16	2.21	3.34	5.55
No-Till	40	Daily	14.31	6.85	50.53	21.16	71.69	3.46	3.56	7.02
No BMPs-Plowdown	40	6-Month	9.33	21.37	66.30	30.70	97.00	0.59	11.11	11.70
Reduced Till-Plowdown	40	6-Month	6.61	10.57	68.55	17.18	85.73	0.33	5.50	5.82
All BMPs-Plowdown	40	6-Month	7.22	6.43	70.33	13.65	83.98	0.34	3.34	3.68
No-Till-Topdress	40	6-Month	9.85	6.85	54.50	16.70	71.19	1.39	3.56	4.95
No BMPs-Plowdown	40	12-Month	9.20	21.37	49.58	30.57	80.15	0.27	11.11	11.38
Reduced Till-Plowdown	40	12-Month	7.82	10.57	51.89	18.38	70.28	0.23	5.50	5.73
All BMPs-Plowdown	40	12-Month	7.96	6.43	55.73	14.39	70.13	0.26	3.34	3.60
No-Till-Topdress	40	12-Month	11.93	6.85	24.41	18.78	43.19	1.55	3.56	5.12
No BMPs-Injection	40	12-Month	15.29	21.37	62.19	36.66	98.85	0.32	11.11	11.43
Reduced Till-Injection	40	12-Month	12.35	10.57	65.55	22.92	88.47	0.29	5.50	5.79
All BMPs-Injection	40	12-Month	13.03	6.43	65.27	19.46	84.73	0.30	3.34	3.64
No-Till-Injection	40	12-Month	15.94	6.85	63.21	22.79	86.00	1.14	3.56	4.70
No BMPs	30	Daily	7.64	17.09	49.95	24.73	74.68	0.96	8.55	9.50
Reduced Till	30	Daily	4.49	8.45	52.04	12.95	64.98	0.38	4.23	4.61
All BMPs	30	Daily	6.34	5.14	52.26	11.49	63.75	0.75	2.57	3.32
No-Till	30	Daily	7.94	5.48	46.82	13.42	60.24	1.69	2.74	4.43
No BMPs-Plowdown	30	6-Month	7.13	17.09	50.67	24.23	74.90	0.48	8.55	9.03
Reduced Till-Plowdown	30	6-Month	5.03	8.45	52.27	13.48	65.75	0.28	4.23	4.51
All BMPs-Plowdown	30	6-Month	5.54	5.14	53.61	10.68	64.29	0.29	2.57	2.87
No-Till-Topdress	30	6-Month	7.51	5.48	41.93	12.99	54.92	1.28	2.74	4.02
No BMPs-Plowdown	30	12-Month	7.03	17.09	38.08	24.12	62.21	0.24	8.55	8.79
Reduced Till-Plowdown	30	12-Month	5.91	8.45	39.46	14.36	53.82	0.21	4.23	4.44
All BMPs-Plowdown	30	12-Month	5.99	5.14	41.51	11.14	52.65	0.23	2.57	2.81
No-Till-Topdress	30	12-Month	9.04	5.48	19.16	14.52	33.68	1.40	2.74	4.14
No BMPs-Injection	30	12-Month	9.48	17.09	28.71	26.57	55.28	0.28	8.55	8.83
Reduced Till-Injection	30	12-Month	7.86	8.45	30.64	16.31	46.95	0.26	4.23	4.49
All BMPs-Injection	30	12-Month	8.30	5.14	31.55	13.44	44.99	0.28	2.57	2.85
No-Till-Injection	30	12-Month	10.12	5.48	29.86	15.60	45.46	1.09	2.74	3.83
No BMPs	20	Daily	6.30	12.82	34.65	19.12	53.77	0.78	6.84	7.62
Reduced Till	20	Daily	3.99	6.34	36.24	10.33	46.56	0.32	3.38	3.70
All BMPs	20	Daily	5.57	3.86	36.55	9.42	45.98	0.70	2.06	2.75
No-Till	20	Daily	7.52	4.11	28.51	11.63	40.14	1.59	2.19	3.78
No BMPs-Plowdown	20	6-Month	5.28	12.82	36.70	18.10	54.80	0.39	6.84	7.22
Reduced Till-Plowdown	20	6-Month	3.75	6.34	37.73	10.09	47.82	0.25	3.38	3.63
All BMPs-Plowdown	20	6-Month	4.14	3.86	38.74	8.00	46.74	0.26	2.06	2.32
No-Till-Topdress	20	6-Month	6.16	4.11	30.57	10.27	40.84	1.13	2.19	3.32
No BMPs-Plowdown	20	12-Month	4.79	12.82	26.11	17.61	43.71	0.23	6.84	7.06
Reduced Till-Plowdown	20	12-Month	3.97	6.34	26.87	10.31	37.18	0.20	3.38	3.58
All BMPs-Plowdown	20	12-Month	4.09	3.86	28.23	7.95	36.18	0.22	2.06	2.28
No-Till-Topdress	20	12-Month	6.11	4.11	13.66	10.22	23.88	1.21	2.19	3.40
No BMPs-Injection	20	12-Month	5.89	12.82	16:30	18.71	35.01	0.26	6.84	7.10
Reduced Till-Injection	20	12-Month	4.93	6.34	17.79	11.27	29.06	0.24	3.38	3.62
All BMPs-Injection	20	12-Month	5.21	3.86	17.99	9.07	27.06	0.25	2.06	2.31
No-Till-Injection	20	12-Month	6.15	4.11	15.81	10.26	26.07	1.00	2.19	3.19

Table B5 -- (Continued.)

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs	15	Daily	5.81	8.55	30.70	14.36	45.06	0.65	4.27	4.92
Reduced Till	15	Daily	3.90	4.23	32.05	8.13	40.18	0.31	2.11	2.42
All BMPs	15	Daily	5.12	2.57	32.54	7.69	40.23	0.60	1.29	1.89
No-Till	15	Daily	7.10	2.74	24.34	9.84	34.18	1.34	1.37	2.71
No BMPs-Plowdown	15	6-Month	5.05	8.55	32.24	13.59	45.83	0.35	4.27	4.63
Reduced Till-Plowdown	15	6-Month	3.72	4.23	33.17	7.95	41.12	0.26	2.11	2.37
All BMPs-Plowdown	15	6-Month	4.05	2.57	34.18	6.62	40.80	0.27	1.29	1.56
No-Till-Topdress	15	6-Month	6.08	2.74	25.89	8.82	34.70	1.00	1.37	2.37
No BMPs-Plowdown	15	12-Month	4.09	8.55	22.32	12.63	34.95	0.21	4.27	4.48
Reduced Till-Plowdown	15	12-Month	3.37	4.23	22.89	7.60	30.49	0.19	2.11	2.30
All BMPs-Plowdown	15	12-Month	3.49	2.57	24.04	6.07	30.10	0.21	1.29	1.49
No-Till-Topdress	15	12-Month	5.93	2.74	12.98	8.67	21.65	1.02	1.37	2.39
No BMPs-Injection	15	12-Month	4.51	8.55	12.78	13.06	25.84	0.23	4.27	4.50
Reduced Till-Injection	15	12-Month	3.74	4.23	13.77	7.97	21.74	0.22	2.11	2.33
All BMPs-Injection	15	12-Month	4.00	2.57	13.91	6.57	20.48	0.23	1.29	1.52
No-Till-Injection	15	12-Month	4.70	2.74	12.53	7.44	19.97	0.88	1.37	2.25
No BMPs	10	Daily	5.25	8.55	27.49	13.80	41.28	0.50	4.27	4.78
Reduced Till	10	Daily	3.75	4.23	28.57	7.97	36.55	0.28	2.11	2.39
All BMPs	10	Daily	4.59	2.57	29.27	7.16	36.44	0.48	1.29	1.76
No-Till	10	Daily	6.72	2.74	20.19	9.46	29.65	1.18	1.37	2.55
No BMPs-Plowdown	10	6-Month	4.74	8.55	28.53	13.29	41.82	0.31	4.27	4.58
Reduced Till-Plowdown	10	6-Month	3.63	4.23	29.33	7.86	37.19	0.24	2.11	2.36
All BMPs-Plowdown	10	6-Month	3.88	2.57	30.39	6.45	36.84	0.26	1.29	1.55
No-Till-Topdress	10	6-Month	6.04	2.74	21.23	8.78	30.01	0.95	1.37	2.32
No BMPs-Plowdown	10	12-Month	4.15	8.55	21.41	12.70	34.11	0.23	4.27	4.50
Reduced Till-Plowdown	10	12-Month	3.44	4.23	22.00	7.66	29.66	0.22	2.11	2.33
All BMPs-Plowdown	10	12-Month	3.56	2.57	23.11	6.13	29.24	0.24	1.29	1.53
No-Till-Topdress	10	12-Month	5.91	2.74	12.61	8.65	21.26	1.00	1.37	2.37
No BMPs-Injection	10	12-Month	4.37	8.55	14.66	12.92	27.58	0.24	4.27	4.51
Reduced Till-Injection	10	12-Month	3.64	4.23	15.27	7.87	23.14	0.24	2.11	2.35
All BMPs-Injection	10	12-Month	3.84	2.57	15.51	6.41	21.92	0.25	1.29	1.54
No-Till-Injection	10	12-Month	4.98	2.74	11.32	7.72	19.04	0.91	1.37	2.28

Table B6 — CREAMS Estimates of Nutrient Losses (lbs/acre) for Corn Silage Following Corn Silage on a 2 Percent Slope

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs	40	Daily	13.57	24.33	53.96	37.90	91.86	2.60	12.65	15.25
Reduced Till	40	Daily	9.62	15.60	56.66	25.22	81.88	1.79	8.11	9.91
All BMPs	40	Daily	9.58	9.13	57.08	18.71	75.79	1.83	4.75	6.57
No-Till	40	Daily	12.18	9.71	50.55	21.89	72.44	2.93	5.05	7.98
No BMPs-Plowdown	40	6-Month	9.33	24.33	66.30	33.66	99.96	0.59	12.65	13.24
Reduced Till-Plowdown	40	6-Month	6.61	15.60	68.55	22.21	90.76	0.33	8.11	8.44
All BMPs-Plowdown	40	6-Month	6.30	9.13	69.12	15.43	84.56	0.31	4.75	5.06
No-Till-Topdress	40	6-Month	8.72	9.71	54.01	18.43	72.44	1.22	5.05	6.27
No BMPs-Plowdown	40	12-Month	9.20	24.33	49.58	33.53	83.11	0.27	12.65	12.92
Reduced Till-Plowdown	40	12-Month	7.82	15.60	51.89	23.42	75.31	0.23	8.11	8.35
All BMPs-Plowdown	40	12-Month	7.94	9.13	55.83	17.07	72.90	0.24	4.75	4.98
No-Till-Topdress	40	12-Month	11.95	9.71	30.50	21.66	52.16	1.33	5.05	6.37
No BMPs-Injection	40	12-Month	15.29	24.33	62.19	39.62	101.81	0.32	12.65	12.97
Reduced Till-Injection	40	12-Month	12.35	15.60	65.55	27.95	93.50	0.29	8.11	8.40
All BMPs-Injection	40	12-Month	12.46	9.13	68.37	21.59	89.96	0.30	4.75	5.05
No-Till-Injection	40	12-Month	15.58	9.71	68.05	25.29	93.34	1.11	5.05	6.16
No BMPs	30	Daily	7.64	19.46	49.95	27.10	77.06	0.96	9.73	10.69
Reduced Till	30	Daily	4.49	12.48	52.04	16.97	69.01	0.38	6.24	6.62
All BMPs	30	Daily	4.33	7.31	52.22	11.64	63.86	0.37	3.65	4.02
No-Till	30	Daily	5.82	7.77	46.85	13.59	60.44	1.17	3.88	5.05
No BMPs-Plowdown	30	6-Month	7.13	19.46	50.67	26.60	77.27	0.48	9.73	10.21
Reduced Till-Plowdown	30	6-Month	5.03	12.48	52.27	17.51	69.78	0.28	6.24	6.52
All BMPs-Plowdown	30	6-Month	4.81	7.31	52.76	12.12	64.88	0.27	3.65	3.92
No-Till-Topdress	30	6-Month	6.65	7.77	41.60	14.41	56.02	1.12	3.88	5.01
No BMPs-Plowdown	30	12-Month	7.03	19.46	38.08	26.49	64.58	0.24	9.73	9.97
Reduced Till-Plowdown	30	12-Month	5.91	12.48	39.46	18.39	57.85	0.21	6.24	6.45
All BMPs-Plowdown	30	12-Month	5.88	7.31	40.08	13.18	53.26	0.21	3.65	3.86
No-Till-Topdress	30	12-Month	8.64	7.77	19.30	16.41	35.71	1.20	3.88	5.08
No BMPs-Injection	30	12-Month	9.48	19.46	28.71	28.94	57.65	0.28	9.73	10.01
Reduced Till-Injection	30	12-Month	7.86	12.48	30.64	20.34	50.98	0.26	6.24	6.50
All BMPs-Injection	30	12-Month	8.21	7.31	34.81	15.52	50.33	0.27	3.65	3.92
No-Till-Injection	30	12-Month	10.28	7.77	35.00	18.05	53.05	1.06	3.88	4.94
No BMPs	20	Daily	6.30	14.60	34.65	20.90	55.55	0.78	7.79	8.57
Reduced Till	20	Daily	3.99	9.36	36.24	13.35	49.58	0.32	4.99	5.31
All BMPs	20	Daily	3.97	5.48	36.43	9.45	45.88	0.32	2.92	3.24
No-Till	20	Daily	5.78	5.82	28.88	11.60	40.48	1.07	3.11	4.18
No BMPs-Plowdown	20	6-Month	5.28	14.60	36.70	19.88	56.58	0.39	7.79	8.17
Reduced Till-Plowdown	20	6-Month	3.75	9.36	37.73	13.11	50.84	0.25	4.99	5.24
All BMPs-Plowdown	20	6-Month	3.62	5.48	38.14	9.10	47.24	0.24	2.92	3.16
No-Till-Topdress	20	6-Month	5.53	5.82	30.42	11.35	41.77	1.00	3.11	4.11
No BMPs-Plowdown	20	12-Month	4.79	14.60	26.11	19.38	45.49	0.23	7.79	8.01
Reduced Till-Plowdown	20	12-Month	3.97	9.36	26.87	13.33	40.20	0.20	4.99	5.19
All BMPs-Plowdown	20	12-Month	3.97	5.48	27.35	9.45	36.80	0.20	2.92	3.12
No-Till-Topdress	20	12-Month	5.83	5.82	13.81	11.66	25.47	1.05	3.11	4.16
No BMPs-Injection	20	12-Month	5.89	14.60	16.30	20.49	36.79	0.26	7.79	8.05
Reduced Till-Injection	20	12-Month	4.93	9.36	17.79	14.29	32.08	0.24	4.99	5.23
All BMPs-Injection	20	12-Month	5.07	5.48	18.20	10.55	28.75	0.25	2.92	3.18
No-Till-Injection	20	12-Month	6.07	5.82	15.94	11.89	27.83	0.94	3.11	4.05

Table B6-- (Continued.)

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs	15	Daily	5.81	9.73	30.70	15.54	46.24	0.65	4.87	5.51
Reduced Till	15	Daily	3.90	6.24	32.05	10.14	42.19	0.31	3.12	3.43
All BMPs	15	Daily	3.89	3.65	32.34	7.54	39.88	0.31	1.83	2.14
No-Till	15	Daily	5.74	3.88	24.67	9.63	34.29	0.94	1.94	2.88
No BMPs-Plowdown	15	6-Month	5.05	9.73	32.24	14.78	47.02	0.35	4.87	5.22
Reduced Till-Plowdown	15	6-Month	3.72	6.24	33.17	9.96	43.13	0.26	3.12	3.38
All BMPs-Plowdown	15	6-Month	3.63	3.65	33.62	7.29	40.91	0.25	1.83	2.08
No-Till-Topdress	15	6-Month	5.56	3.88	25.82	9.44	35.26	0.89	1.94	2.83
No BMPs-Plowdown	15	12-Month	4.09	9.73	22.32	13.82	36.14	0.21	4.87	5.08
Reduced Till-Plowdown	15	12-Month	3.37	6.24	22.89	9.61	32.50	0.19	3.12	3.31
All BMPs-Plowdown	15	12-Month	3.38	3.65	23.33	7.03	30.36	0.19	1.83	2.01
No-Till-Topdress	15	12-Month	5.66	3.88	13.14	9.54	22.68	0.89	1.94	2.83
No BMPs-Injection	15	12-Month	4.51	9.73	12.78	14.24	27.02	0.23	4.87	5.10
Reduced Till-Injection	15	12-Month	3.74	6.24	13.77	9.98	23.75	0.22	3.12	3.34
All BMPs-Injection	15	12-Month	3.87	3.65	14.12	7.52	21.64	0.23	1.83	2.06
No-Till-Injection	15	12-Month	4.63	3.88	12.67	8.51	21.18	0.85	1.94	2.79
No BMPs	10	Daily	5.25	9.73	27.49	14.98	42.47	0.50	4.87	5.37
Reduced Till	10	Daily	3.75	6.24	28.57	9.99	38.56	0.28	3.12	3.40
All BMPs	10	Daily	3.74	3.65	28.92	7.40	36.31	0.28	1.83	2.11
No-Till	10	Daily	5.73	3.88	20.48	9.62	30.09	0.89	1.94	2.83
No BMPs-Plowdown	10	6-Month	4.74	9.73	28.53	14.48	43.00	0.31	4.87	5.18
Reduced Till-Plowdown	10	6-Month	3.63	6.24	29.33	9.87	39.20	0.24	3.12	3.36
All BMPs-Plowdown	10	6-Month	3.57	3.65	29.79	7.23	37.01	0.24	1.83	2.07
No-Till-Topdress	10	6-Month	5.61	3.88	21.25	9.50	30.75	0.85	1.94	2.79
No BMPs-Plowdown	10	12-Month	4.15	9.73	21.41	13.88	35.30	0.23	4.87	5.10
Reduced Till-Plowdown	10	12-Month	3.44	6.24	22.00	9.68	31.68	0.22	3.12	3.34
All BMPs-Plowdown	10	12-Month	3.45	3.65	22.47	7.10	29.57	0.22	1.83	2.05
No-Till-Topdress	10	12-Month	5.66	3.88	12.79	9.54	22.33	0.88	1.94	2.82
No BMPs-Injection	10	12-Month	4.37	9.73	14.66	14.10	28.76	0.24	4.87	5.11
Reduced Till-Injection	10	12-Month	3.64	6.24	15.27	9.88	25.15	0.24	3.12	3.36
All BMPs-Injection	10	12-Month	3.73	3.65	15.48	7.38	22.86	0.24	1.83	2.07
No-Till-Injection	10	12-Month	4.87	3.88	11.45	8.75	20.20	0.88	1.94	2.82

Table B7-- CREAMS Estimates of Nutrient Losses (lbs/acre) for Corn Grain Following Alfalfa on a 5 Percent Slope

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs	40	Daily	14.55	41.63	61.33	56.18	117.51	2.33	21.65	23.98
Terraces	40	Daily	13.34	16.13	63.92	29.47	93.38	2.09	8.39	10.47
Reduced Till	40	Daily	12.87	15.53	62.16	28.41	90.56	2.08	8.08	10.16
All BMPs	40	Daily	12.72	6.22	64.62	18.94	83.56	2.08	3.23	5.31
No-Till	40	Daily	20.74	8.40	52.95	29.14	82.08	4.30	4.37	8.67
No BMPs-Plowdown	40	6-Month	11.41	41.63	69.33	53.05	122.38	0.62	21.65	22.27
Terraces-Plowdown	40	6-Month	10.37	16.13	71.68	26.50	98.18	0.53	8.39	8.92
Reduced Till-Plowdown	40	6-Month	10.04	15.53	70.82	25.57	96.39	0.56	8.08	8.64
All BMPs-Plowdown	40	6-Month	9.62	6.22	72.21	15.83	88.05	0.55	3.23	3.79
No-Till-Topdress	40	6-Month	15.39	8.40	56.80	23.79	80.59	1.68	4.37	6.05
No BMPs-Plowdown	40	12-Month	14.35	41.63	84.58	55.98	140.57	0.24	21.65	21.89
Terraces-Plowdown	40	12-Month	13.04	16.13	85.42	29.17	114.59	0.22	8.39	8.61
Reduced Till-Plowdown	40	12-Month	12.64	15.53	88.21	28.18	116.38	0.24	8.08	8.31
All BMPs-Plowdown	40	12-Month	11.80	6.22	86.62	18.02	104.64	0.24	3.23	3.48
No-Till-Topdress	40	12-Month	19.17	8.40	61.74	27.57	89.31	1.47	4.37	5.84
No BMPs-Injection	40	12-Month	18.66	41.63	99.74	60.29	160.03	0.32	21.65	21.97
Terraces-Injection	40	12-Month	17.22	16.13	102.09	33.35	135.44	0.29	8.39	8.68
Reduced Till-Injection	40	12-Month	16.20	15.53	101.26	31.73	132.99	0.29	8.08	8.37
All BMPs-Injection	40	12-Month	15.88	6.22	94.30	22.10	116.40	0.29	3.23	3.52
No-Till-Injection	40	12-Month	22.74	8.40	95.64	31.14	126.78	1.14	4.37	5.51
No BMPs	30	Daily	8.61	33.31	57.28	41.92	99.20	0.69	16.65	17.35
Terraces	30	Daily	8.01	12.90	59.28	20.91	80.19	0.64	6.45	7.09
Reduced Till	30	Daily	7.73	12.43	57.52	20.15	77.68	0.67	6.21	6.88
All BMPs	30	Daily	7.53	4.97	59.74	12.50	72.25	0.66	2.49	3.15
No-Till	30	Daily	14.01	6.72	46.98	20.73	67.71	2.53	3.36	5.89
No BMPs-Plowdown	30	6-Month	9.20	33.31	55.04	42.51	97.55	0.50	16.65	17.15
Terraces-Plowdown	30	6-Month	8.40	12.90	57.08	21.30	78.39	0.43	6.45	6.88
Reduced Till-Plowdown	30	6-Month	8.06	12.43	55.51	20.49	76.00	0.46	6.21	6.67
All BMPs-Plowdown	30	6-Month	7.79	4.97	57.56	12.77	70.32	0.45	2.49	2.94
No-Till-Topdress	30	6-Month	11.98	6.72	41.48	18.70	60.18	1.49	3.36	4.86
No BMPs-Plowdown	30	12-Month	10.58	33.31	57.59	43.89	101.48	0.21	16.65	16.87
Terraces-Plowdown	30	12-Month	9.63	12.90	58.13	22.54	80.67	0.20	6.45	6.65
Reduced Till-Plowdown	30	12-Month	9.32	12.43	60.60	21.75	82.35	0.21	6.21	6.43
All BMPs-Plowdown	30	12-Month	8.70	4.97	59.25	13.68	72.93	0.22	2.49	2.71
No-Till-Topdress	30	12-Month	14.26	6.72	40.66	20.98	61.64	1.34	3.36	4.70
No BMPs-Injection	30	12-Month	13.67	33.31	68.98	46.98	115.96	0.27	16.65	16.92
Terraces-Injection	30	12-Month	12.64	12.90	70.66	25.54	96.20	0.25	6.45	6.70
Reduced Till-Injection	30	12-Month	11.86	12.43	70.41	24.29	94.70	0.26	6.21	6.47
All BMPs-Injection	30	12-Month	11.63	4.97	65.21	16.60	81.81	0.27	2.49	2.76
No-Till-Injection	30	12-Month	16.74	6.72	66.10	23.46	89.56	1.10	3.36	4.46
No BMPs	20	Daily	6.47	24.98	39.20	31.45	70.65	0.49	13.32	13.81
Terraces	20	Daily	6.12	9.68	41.02	15.80	56.82	0.48	5.16	5.64
Reduced Till	20	Daily	5.84	9.32	39.80	15.16	54.96	0.49	4.97	5.46
All BMPs	20	Daily	5.73	3.73	41.86	9.46	51.32	0.49	1.99	2.48
No-Till	20	Daily	11.21	5.04	29.65	16.25	45.90	2.27	2.69	4.96
No BMPs-Plowdown	20	6-Month	6.96	24.98	40.49	31.94	72.43	0.39	13.32	13.72
Terraces-Plowdown	20	6-Month	6.37	9.68	41.99	16.05	58.04	0.34	5.16	5.50
Reduced Till-Plowdown	20	6-Month	6.10	9.32	40.82	15.42	56.24	0.37	4.97	5.34
All BMPs-Plowdown	20	6-Month	5.91	3.73	42.39	9.64	52.03	0.36	1.99	2.35
No-Till-Topdress	20	6-Month	9.15	5.04	30.13	14.19	44.32	1.29	2.69	3.98

Table B7-- (Continued.)

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs-Plowdown	20	12-Month	7.16	24.98	33.46	32.14	65.59	0.20	13.32	13.52
Terraces-Plowdown	20	12-Month	6.65	9.68	34.48	16.33	50.81	0.19	5.16	5.35
Reduced Till-Plowdown	20	12-Month	6.24	9.32	34.78	15.56	50.34	0.20	4.97	5.17
All BMPs-Plowdown	20	12-Month	6.08	3.73	36.97	9.81	46.78	0.21	1.99	2.19
No-Till-Topdress	20	12-Month	9.23	5.04	18.43	14.27	32.70	1.18	2.69	3.87
No BMPs-Injection	20	12-Month	8.54	24.98	37.32	33.52	70.84	0.25	13.32	13.57
Terraces-Injection	20	12-Month	7.95	9.68	37.01	17.63	54.64	0.24	5.16	5.40
Reduced Till-Injection	20	12-Month	7.43	9.32	38.69	16.75	55.44	0.24	4.97	5.21
All BMPs-Injection	20	12-Month	7.34	3.73	35.31	11.07	46.38	0.24	1.99	2.23
No-Till-Injection	20	12-Month	10.52	5.04	35.64	15.56	51.20	1.03	2.69	3.72
No BMPs	15	Daily	5.47	16.65	32.24	22.13	54.37	0.43	8.33	8.75
Terraces	15	Daily	5.17	6.45	33.71	11.62	45.33	0.41	3.23	3.64
Reduced Till	15	Daily	4.92	6.21	32.70	11.14	43.84	0.44	3.11	3.55
All BMPs	15	Daily	4.83	2.49	34.40	7.32	41.72	0.44	1.24	1.69
No-Till	15	Daily	9.28	3.36	24.08	12.64	36.72	1.86	1.68	3.54
No BMPs-Plowdown	15	6-Month	5.85	16.65	33.21	22.50	55.71	0.35	8.33	8.68
Terraces-Plowdown	15	6-Month	5.36	6.45	34.45	11.81	46.26	0.31	3.23	3.53
Reduced Till-Plowdown	15	6-Month	5.12	6.21	33.47	11.34	44.81	0.35	3.11	3.45
All BMPs-Plowdown	15	6-Month	4.97	2.49	34.81	7.45	42.26	0.35	1.24	1.59
No-Till-Topdress	15	6-Month	7.73	3.36	24.44	11.10	35.54	1.12	1.68	2.80
No BMPs-Plowdown	15	12-Month	5.99	16.65	27.94	22.64	50.59	0.19	8.33	8.52
Terraces-Plowdown	15	12-Month	5.57	6.45	29.72	12.02	41.74	0.18	3.23	3.40
Reduced Till-Plowdown	15	12-Month	5.23	6.21	28.95	11.44	40.39	0.19	3.11	3.30
All BMPs-Plowdown	15	12-Month	5.09	2.49	30.75	7.58	38.33	0.19	1.24	1.44
No-Till-Topdress	15	12-Month	7.78	3.36	15.51	11.14	26.65	1.00	1.68	2.68
No BMPs-Injection	15	12-Month	6.03	16.65	36.04	22.68	58.72	0.22	8.33	8.55
Terraces-Injection	15	12-Month	6.00	6.45	23.85	12.45	36.30	0.21	3.23	3.44
Reduced Till-Injection	15	12-Month	5.54	6.21	23.44	11.75	35.19	0.22	3.11	3.33
All BMPs-Injection	15	12-Month	5.66	2.49	23.92	8.15	32.07	0.23	1.24	1.47
No-Till-Injection	15	12-Month	7.79	3.36	20.70	11.15	31.85	0.89	1.68	2.57
No BMPs	10	Daily	4.62	16.65	25.57	21.28	46.85	0.35	8.33	8.68
Terraces	10	Daily	4.35	6.45	26.74	10.80	37.54	0.34	3.23	3.56
Reduced Till	10	Daily	4.14	6.21	25.94	10.35	36.29	0.37	3.11	3.47
All BMPs	10	Daily	4.06	2.49	27.30	6.55	33.85	0.37	1.24	1.61
No-Till	10	Daily	7.51	3.36	18.79	10.87	29.66	1.53	1.68	3.21
No BMPs-Plowdown	10	6-Month	4.73	16.65	25.94	21.38	47.32	0.30	8.33	8.63
Terraces-Plowdown	10	6-Month	4.34	6.45	26.91	10.79	37.70	0.27	3.23	3.50
Reduced Till-Plowdown	10	6-Month	4.15	6.21	26.13	10.36	36.49	0.30	3.11	3.41
All BMPs-Plowdown	10	6-Month	4.02	2.49	27.23	6.51	33.74	0.30	1.24	1.55
No-Till-Topdress	10	6-Month	6.32	3.36	18.77	9.68	28.45	1.04	1.68	2.72
No BMPs-Plowdown	10	12-Month	4.82	16.65	22.42	21.48	43.90	0.21	8.33	8.54
Terraces-Plowdown	10	12-Month	4.48	6.45	23.75	10.93	34.69	0.19	3.23	3.42
Reduced Till-Plowdown	10	12-Month	4.21	6.21	23.11	10.43	33.54	0.22	3.11	3.33
All BMPs-Plowdown	10	12-Month	4.11	2.49	24.52	6.59	31.12	0.23	1.24	1.47
No-Till-Topdress	10	12-Month	6.35	3.36	12.81	9.71	22.52	0.99	1.68	2.67
No BMPs-Injection	10	12-Month	5.13	16.65	17.95	21.78	39.73	0.23	8.33	8.56
Terraces-Injection	10	12-Month	4.81	6.45	18.93	11.26	30.19	0.22	3.23	3.45
Reduced Till-Injection	10	12-Month	4.47	6.21	18.61	10.68	29.29	0.23	3.11	3.34
All BMPs-Injection	10	12-Month	4.53	2.49	19.03	7.02	26.05	0.24	1.24	1.48
No-Till-Injection	10	12-Month	6.19	3.36	12.62	9.55	22.17	0.91	1.68	2.59

Table B8 -- CREAMS Estimates of Nutrient Losses (lbs/acre) for Corn Grain Following Corn Grain on a 5 Percent Slope

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs	40	Daily	16.39	53.28	52.85	69.67	122.52	3.24	27.70	30.95
Terraces	40	Daily	15.20	20.08	54.82	35.28	90.10	2.97	10.44	13.41
Reduced Till	40	Daily	13.21	22.90	54.09	36.11	90.20	2.54	11.91	14.45
All BMPs	40	Daily	14.79	7.71	55.27	22.50	77.77	2.96	4.01	6.97
No-Till	40	Daily	19.35	14.66	47.26	34.01	81.27	4.81	7.62	12.43
No BMPs-Plowdown	40	6-Month	10.69	53.28	63.31	63.96	127.27	0.65	27.70	28.35
Terraces-Plowdown	40	6-Month	9.78	20.08	65.10	29.86	94.97	0.55	10.44	10.99
Reduced Till-Plowdown	40	6-Month	8.97	22.90	63.50	31.87	95.37	0.58	11.91	12.49
All BMPs-Plowdown	40	6-Month	9.27	7.71	65.51	16.98	82.49	0.58	4.01	4.59
No-Till-Topdress	40	6-Month	12.55	14.66	49.95	27.21	77.16	1.76	7.62	9.38
No BMPs-Plowdown	40	12-Month	11.44	53.28	65.22	64.72	129.93	0.26	27.70	27.97
Terraces-Plowdown	40	12-Month	10.36	20.08	65.65	30.44	96.09	0.25	10.44	10.69
Reduced Till-Plowdown	40	12-Month	9.96	22.90	68.99	32.86	101.85	0.25	11.91	12.16
All BMPs-Plowdown	40	12-Month	9.65	7.71	68.02	17.37	85.39	0.27	4.01	4.28
No-Till-Topdress	40	12-Month	14.66	14.66	40.56	29.32	69.87	1.61	7.62	9.23
No BMPs-Injection	40	12-Month	17.43	53.28	78.41	70.70	149.11	0.32	27.70	28.02
Terraces-Injection	40	12-Month	16.15	20.08	80.28	36.23	116.51	0.30	10.44	10.74
Reduced Till-Injection	40	12-Month	14.60	22.90	79.61	37.50	117.11	0.30	11.91	12.21
All BMPs-Injection	40	12-Month	14.89	7.71	73.10	22.60	95.71	0.32	4.01	4.33
No-Till-Injection	40	12-Month	18.71	14.66	76.98	33.37	110.35	1.15	7.62	8.77
No BMPs	30	Daily	10.45	42.62	48.81	53.07	101.88	1.60	21.31	22.91
Terraces	30	Daily	9.87	16.06	50.19	25.93	76.12	1.52	8.03	9.55
Reduced Till	30	Daily	8.06	18.32	49.46	26.38	75.84	1.12	9.16	10.28
All BMPs	30	Daily	9.59	6.17	50.39	15.76	66.15	1.54	3.09	4.63
No-Till	40	Daily	12.96	11.73	43.54	24.69	68.22	3.04	5.86	8.90
No BMPs-Plowdown	30	6-Month	8.29	42.62	48.61	50.91	99.51	0.52	21.31	21.83
Terraces-Plowdown	30	6-Month	7.59	16.06	49.89	23.66	73.55	0.45	8.03	8.48
Reduced Till-Plowdown	30	6-Month	6.95	18.32	48.65	25.27	73.92	0.47	9.16	9.63
All BMPs-Plowdown	30	6-Month	7.20	6.17	50.17	13.37	63.54	0.47	3.09	3.56
No-Till-Topdress	30	6-Month	9.69	11.73	38.60	21.42	60.02	1.56	5.86	7.43
No BMPs-Plowdown	30	12-Month	7.63	42.62	38.83	50.25	89.09	0.24	21.31	21.55
Terraces-Plowdown	30	12-Month	7.11	16.06	41.24	23.17	64.41	0.22	8.03	8.25
Reduced Till-Plowdown	30	12-Month	6.59	18.32	40.13	24.91	65.04	0.23	9.16	9.39
All BMPs-Plowdown	30	12-Month	6.64	6.17	42.99	12.81	55.80	0.24	3.09	3.33
No-Till-Topdress	30	12-Month	9.73	11.73	19.52	21.46	40.98	1.45	5.86	7.31
No BMPs-Injection	30	12-Month	11.77	42.62	47.13	54.39	101.52	0.28	21.31	21.59
Terraces-Injection	30	12-Month	10.93	16.06	48.38	26.99	75.37	0.26	8.03	8.29
Reduced Till-Injection	30	12-Month	9.91	18.32	48.11	28.23	76.34	0.26	9.16	9.42
All BMPs-Injection	30	12-Month	10.05	6.17	43.56	16.22	59.78	0.28	3.09	3.37
No-Till-Injection	30	12-Month	12.61	11.73	46.27	24.33	70.60	1.11	5.86	6.97
No BMPs	20	Daily	8.17	31.97	32.54	40.13	72.67	1.40	17.05	18.45
Terraces	20	Daily	7.83	12.05	33.94	19.87	53.81	1.35	6.43	7.78
Reduced Till	20	Daily	6.23	13.74	33.55	19.96	53.51	0.95	7.33	8.27
All BMPs	20	Daily	7.62	4.63	34.61	12.25	46.86	1.37	2.47	3.84
No-Till	20	Daily	10.67	8.80	26.38	19.47	45.85	2.78	4.69	7.47
No BMPs-Plowdown	20	6-Month	5.81	31.97	33.42	37.77	71.19	0.41	17.05	17.46
Terraces-Plowdown	20	6-Month	5.33	12.05	34.17	17.38	51.55	0.36	6.43	6.79
Reduced Till-Plowdown	20	6-Month	4.87	13.74	33.30	18.61	51.91	0.38	7.33	7.71
All BMPs-Plowdown	20	6-Month	5.06	4.63	34.30	9.69	44.00	0.38	2.47	2.85
No-Till-Topdress	20	6-Month	6.97	8.80	27.15	15.77	42.92	1.34	4.69	6.03

Table B8 --(Continued.)

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs-Plowdown	20	12-Month	5.37	31.97	26.88	37.33	64.21	0.22	17.05	17.27
Terraces-Plowdown	20	12-Month	5.00	12.05	28.38	17.05	45.43	0.21	6.43	6.63
Reduced Till-Plowdown	20	12-Month	4.63	13.74	27.59	18.37	45.95	0.22	7.33	7.54
All BMPs-Plowdown	20	12-Month	4.68	4.63	29.50	9.31	38.81	0.23	2.47	2.69
No-Till-Topdress	20	12-Month	6.78	8.80	14.05	15.57	29.62	1.26	4.69	5.96
No BMPs-Injection	20	12-Month	6.38	31.97	17.15	38.34	55.50	0.25	17.05	17.30
Terraces-Injection	20	12-Month	6.03	12.05	18.73	18.08	36.81	0.24	6.43	6.67
Reduced Till-Injection	20	12-Month	5.50	13.74	18.56	19.23	37.80	0.24	7.33	7.57
All BMPs-Injection	20	12-Month	5.77	4.63	18.77	10.40	29.18	0.25	2.47	2.72
No-Till-Injection	20	12-Month	6.72	8.80	16.27	15.52	31.78	1.03	4.69	5.72
No BMPs	15	Daily	7.21	21.31	28.63	28.52	57.15	1.11	10.65	11.77
Terraces	15	Daily	6.89	8.03	29.94	14.92	44.85	1.07	4.02	5.09
Reduced Till	15	Daily	5.62	9.16	29.51	14.78	44.28	0.79	4.58	5.37
All BMPs	15	Daily	6.68	3.09	30.58	9.77	40.35	1.11	1.54	2.65
No-Till	15	Daily	9.41	5.86	22.55	15.28	37.83	2.24	2.93	5.17
No BMPs-Plowdown	15	6-Month	5.34	21.31	28.75	26.65	55.40	0.37	10.65	11.03
Terraces-Plowdown	15	6-Month	4.92	8.03	29.51	12.95	42.46	0.33	4.02	4.34
Reduced Till-Plowdown	15	6-Month	4.52	9.16	28.75	13.67	42.43	0.36	4.58	4.94
All BMPs-Plowdown	15	6-Month	4.67	3.09	29.74	7.76	37.50	0.36	1.54	1.91
No-Till-Topdress	15	6-Month	6.64	5.86	23.13	12.50	35.63	1.16	2.93	4.09
No BMPs-Plowdown	15	12-Month	4.24	21.31	20.93	25.55	46.48	0.21	10.65	10.86
Terraces-Plowdown	15	12-Month	3.95	8.03	21.98	11.98	33.96	0.20	4.02	4.21
Reduced Till-Plowdown	15	12-Month	3.65	9.16	21.35	12.81	34.16	0.20	4.58	4.78
All BMPs-Plowdown	15	12-Month	3.71	3.09	22.78	6.80	29.58	0.21	1.54	1.76
No-Till-Topdress	15	12-Month	5.73	5.86	12.03	11.59	23.62	1.06	2.93	3.99
No BMPs-Injection	15	12-Month	4.99	21.31	13.62	26.30	39.92	0.23	10.65	10.88
Terraces-Injection	15	12-Month	4.72	8.03	14.72	12.75	27.47	0.22	4.02	4.24
Reduced Till-Injection	15	12-Month	4.30	9.16	14.56	13.46	28.02	0.22	4.58	4.80
All BMPs-Injection	15	12-Month	4.52	3.09	14.70	7.61	22.31	0.23	1.54	1.77
No-Till-Injection	15	12-Month	5.26	5.86	12.99	11.12	24.11	0.89	2.93	3.82
No BMPs	10	Daily	6.19	21.31	25.45	27.50	52.95	0.81	10.65	11.46
Terraces	10	Daily	5.87	8.03	26.63	13.91	40.54	0.78	4.02	4.79
Reduced Till	10	Daily	4.94	9.16	26.17	14.10	40.27	0.60	4.58	5.18
All BMPs	10	Daily	5.66	3.09	27.33	8.75	36.08	0.81	1.54	2.35
No-Till	10	Daily	8.19	5.86	18.74	14.05	32.79	1.78	2.93	4.72
No BMPs-Plowdown	10	6-Month	4.94	21.31	25.53	26.25	51.78	0.32	10.65	10.98
Terraces-Plowdown	10	6-Month	4.56	8.03	26.37	12.60	38.96	0.29	4.02	4.30
Reduced Till-Plowdown	10	6-Month	4.20	9.16	25.67	13.36	39.03	0.32	4.58	4.90
All BMPs-Plowdown	10	6-Month	4.33	3.09	26.77	7.41	34.19	0.32	1.54	1.87
No-Till-Topdress	10	6-Month	6.34	5.86	19.12	12.21	31.33	1.07	2.93	4.01
No BMPs-Plowdown	10	12-Month	4.16	21.31	19.33	25.47	44.80	0.23	10.65	10.88
Terraces-Plowdown	10	12-Month	3.88	8.03	20.32	11.91	32.22	0.21	4.02	4.23
Reduced Till-Plowdown	10	12-Month	3.59	9.16	19.74	12.75	32.49	0.24	4.58	4.82
All BMPs-Plowdown	10	12-Month	3.65	3.09	21.05	6.74	27.79	0.25	1.54	1.79
No-Till-Topdress	10	12-Month	5.71	5.86	11.71	11.57	23.29	1.04	2.93	3.97
No BMPs-Injection	10	12-Month	4.38	21.31	13.01	25.69	38.70	0.24	10.65	10.89
Terraces-Injection	10	12-Month	4.13	8.03	13.91	12.16	26.07	0.23	4.02	4.25
Reduced Till-Injection	10	12-Month	3.78	9.16	13.70	12.94	26.64	0.25	4.58	4.83
All BMPs-Injection	10	12-Month	3.95	3.09	13.88	7.04	20.92	0.26	1.54	1.80
No-Till-Injection	10	12-Month	4.79	5.86	11.09	10.65	21.74	0.92	2.93	3.85

Table B9 -- CREAMS Estimates of Nutrient Losses (lbs/acre) for Corn Grain Following Corn Silage on a 5 Percent Slope

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs	40	Daily	16.39	62.09	52.85	78.49	131.34	3.24	32.29	35.53
Terraces	40	Daily	15.20	23.67	54.82	38.87	93.69	2.97	12.31	15.28
Reduced Till	40	Daily	13.21	34.44	54.09	47.66	101.75	2.54	17.91	20.45
All BMPs	40	Daily	11.21	11.00	55.27	22.21	77.48	2.08	5.72	7.80
No-Till	40	Daily	17.79	22.91	46.98	40.70	87.69	4.30	11.92	16.22
No BMPs-Plowdown	40	6-Month	10.69	62.09	63.31	72.78	136.09	0.65	32.29	32.94
Terraces-Plowdown	40	6-Month	9.78	23.67	65.10	33.46	98.56	0.55	12.31	12.86
Reduced Till-Plowdown	40	6-Month	8.97	34.44	63.50	43.41	106.91	0.58	17.91	18.49
All BMPs-Plowdown	40	6-Month	8.08	11.00	65.51	19.08	84.58	0.55	5.72	6.27
No-Till-Topdress	40	6-Month	12.10	22.91	48.80	35.02	83.81	1.68	11.92	13.59
No BMPs-Plowdown	40	12-Month	11.44	62.09	65.22	73.53	138.75	0.26	32.29	32.55
Terraces-Plowdown	40	12-Month	10.36	23.67	65.65	34.04	99.68	0.25	12.31	12.56
Reduced Till-Plowdown	40	12-Month	9.96	34.44	68.99	44.40	113.39	0.25	17.91	18.16
All BMPs-Plowdown	40	12-Month	9.28	11.00	68.02	20.28	88.30	0.24	5.72	5.96
No-Till-Topdress	40	12-Month	14.59	22.91	43.30	37.50	80.81	1.47	11.92	13.38
No BMPs-Injection	40	12-Month	17.43	62.09	78.41	79.52	157.93	0.32	32.29	32.61
Terraces-Injection	40	12-Month	16.15	23.67	80.28	39.82	120.10	0.30	12.31	12.61
Reduced Till-Injection	40	12-Month	14.60	34.44	79.61	49.04	128.65	0.30	17.91	18.21
All BMPs-Injection	40	12-Month	13.75	11.00	73.10	24.75	97.85	0.30	5.72	6.02
No-Till-Injection	40	12-Month	18.68	22.91	77.74	41.59	119.33	1.14	11.92	13.06
No BMPs	30	Daily	10.45	49.67	48.81	60.12	108.93	1.60	24.84	26.44
Terraces	30	Daily	9.87	18.94	50.19	28.80	79.00	1.52	9.47	10.99
Reduced Till	30	Daily	8.06	27.55	49.46	35.62	85.08	1.12	13.78	14.90
All BMPs	30	Daily	6.03	8.80	50.39	14.82	65.21	0.66	4.40	5.06
No-Till	30	Daily	11.40	18.33	43.28	29.73	73.02	2.53	9.17	11.70
No BMPs-Plowdown	30	6-Month	8.29	49.67	48.61	57.96	106.57	0.52	24.84	25.36
Terraces-Plowdown	30	6-Month	7.59	18.94	49.89	26.53	76.42	0.45	9.47	9.92
Reduced Till-Plowdown	30	6-Month	6.95	27.55	48.65	34.51	83.16	0.47	13.78	14.25
All BMPs-Plowdown	30	6-Month	6.26	8.80	50.17	15.06	65.23	0.45	4.40	4.85
No-Till-Topdress	30	6-Month	9.37	18.33	37.73	27.70	65.43	1.49	9.17	10.66
No BMPs-Plowdown	30	12-Month	7.63	49.67	38.83	57.31	96.14	0.24	24.84	25.07
Terraces-Plowdown	30	12-Month	7.11	18.94	41.24	26.04	67.28	0.22	9.47	9.69
Reduced Till-Plowdown	30	12-Month	6.59	27.55	40.13	34.15	74.27	0.23	13.78	14.01
All BMPs-Plowdown	30	12-Month	6.48	8.80	42.99	15.28	58.27	0.22	4.40	4.62
No-Till-Topdress	30	12-Month	9.73	18.33	21.97	28.06	50.03	1.34	9.17	10.51
No BMPs-Injection	30	12-Month	11.77	49.67	47.13	61.44	108.57	0.28	24.84	25.12
Terraces-Injection	30	12-Month	10.93	18.94	48.38	29.87	78.25	0.26	9.47	9.73
Reduced Till-Injection	30	12-Month	9.91	27.55	48.11	37.46	85.57	0.26	13.78	14.04
All BMPs-Injection	30	12-Month	9.51	8.80	43.56	18.31	61.87	0.26	4.40	4.66
No-Till-Injection	30	12-Month	12.77	18.33	47.81	31.10	78.91	1.10	9.17	10.27
No BMPs	20	Daily	8.17	37.26	32.54	45.42	77.96	1.40	19.87	21.27
Terraces	20	Daily	7.83	14.20	33.94	22.03	55.97	1.35	7.57	8.93
Reduced Till	20	Daily	6.23	20.67	33.55	26.89	60.44	0.95	11.02	11.97
All BMPs	20	Daily	4.58	6.60	34.61	11.18	45.79	0.49	3.52	4.01
No-Till	20	Daily	9.24	13.75	26.71	22.99	49.70	2.27	7.33	9.60
No BMPs-Plowdown	20	6-Month	5.81	37.26	33.42	43.06	76.48	0.41	19.87	20.28
Terraces-Plowdown	20	6-Month	5.33	14.20	34.17	19.53	53.71	0.36	7.57	7.94
Reduced Till-Plowdown	20	6-Month	4.87	20.67	33.30	25.54	58.84	0.38	11.02	11.40
All BMPs-Plowdown	20	6-Month	4.38	6.60	34.30	10.98	45.28	0.36	3.52	3.88
No-Till-Topdress	20	6-Month	6.77	13.75	26.58	20.51	47.10	1.29	7.33	8.62

Table B9 —(Continued.)

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs-Plowdown	20	12-Month	5.37	37.26	26.88	42.62	69.50	0.22	19.87	20.09
Terraces-Plowdown	20	12-Month	5.00	14.20	28.38	19.20	47.59	0.21	7.57	7.78
Reduced Till-Plowdown	20	12-Month	4.63	20.67	27.59	25.29	52.88	0.22	11.02	11.24
All BMPs-Plowdown	20	12-Month	4.52	6.60	29.50	11.12	40.62	0.21	3.52	3.72
No-Till-Topdress	20	12-Month	6.62	13.75	14.03	20.37	34.40	1.18	7.33	8.52
No BMPs-Injection	20	12-Month	6.38	37.26	17.15	43.64	60.79	0.25	19.87	20.12
Terraces-Injection	20	12-Month	6.03	14.20	18.73	20.23	38.96	0.24	7.57	7.81
Reduced Till-Injection	20	12-Month	5.50	20.67	18.56	26.17	44.73	0.24	11.02	11.26
All BMPs-Injection	20	12-Month	5.59	6.60	18.77	12.19	30.96	0.24	3.52	3.76
No-Till-Injection	20	12-Month	6.80	13.75	16.82	20.55	37.37	1.02	7.33	8.35
No BMPs	15	Daily	7.21	24.84	28.63	32.05	60.68	1.11	12.42	13.53
Terraces	15	Daily	6.89	9.47	29.94	16.35	46.29	1.07	4.73	5.81
Reduced Till	15	Daily	5.62	13.78	29.51	19.40	48.90	0.79	6.89	7.67
All BMPs	15	Daily	4.36	4.40	30.58	8.76	39.35	0.44	2.20	2.64
No-Till	15	Daily	8.32	9.17	22.80	17.49	40.29	1.86	4.58	6.44
No BMPs-Plowdown	15	6-Month	5.34	24.84	28.75	30.18	58.93	0.37	12.42	12.79
Terraces-Plowdown	15	6-Month	4.92	9.47	29.51	14.38	43.89	0.33	4.73	5.06
Reduced Till-Plowdown	15	6-Month	4.52	13.78	28.75	18.29	47.04	0.36	6.89	7.25
All BMPs-Plowdown	15	6-Month	4.12	4.40	29.74	8.52	38.27	0.35	2.20	2.54
No-Till-Topdress	15	6-Month	6.47	9.17	22.71	15.63	38.34	1.12	4.58	5.70
No BMPs-Plowdown	15	12-Month	4.24	24.84	20.93	29.08	50.01	0.21	12.42	12.63
Terraces-Plowdown	15	12-Month	3.95	9.47	21.98	13.42	35.40	0.20	4.73	4.93
Reduced Till-Plowdown	15	12-Month	3.65	13.78	21.35	17.43	38.78	0.20	6.89	7.09
All BMPs-Plowdown	15	12-Month	3.55	4.40	22.78	7.95	30.73	0.19	2.20	2.39
No-Till-Topdress	15	12-Month	5.61	9.17	12.02	14.78	26.80	1.00	4.58	5.58
No BMPs-Injection	15	12-Month	4.99	24.84	13.62	29.83	43.45	0.23	12.42	12.65
Terraces-Injection	15	12-Month	4.72	9.47	14.72	14.19	28.91	0.22	4.73	4.95
Reduced Till-Injection	15	12-Month	4.30	13.78	14.56	18.08	32.64	0.22	6.89	7.11
All BMPs-Injection	15	12-Month	4.36	4.40	14.70	8.76	23.46	0.22	2.20	2.42
No-Till-Injection	15	12-Month	5.29	9.17	12.97	14.46	27.43	0.89	4.58	5.47
No BMPs	10	Daily	6.19	24.84	25.45	31.03	56.48	0.81	12.42	13.23
Terraces	10	Daily	5.87	9.47	26.63	15.34	41.98	0.78	4.73	5.51
Reduced Till	10	Daily	4.94	13.78	26.17	18.72	44.89	0.60	6.89	7.49
All BMPs	10	Daily	4.07	4.40	27.33	8.47	35.81	0.37	2.20	2.57
No-Till	10	Daily	7.43	9.17	18.92	16.59	35.51	1.53	4.58	6.11
No BMPs-Plowdown	10	6-Month	4.94	24.84	25.53	29.78	55.31	0.32	12.42	12.74
Terraces-Plowdown	10	6-Month	4.56	9.47	26.37	14.03	40.40	0.29	4.73	5.02
Reduced Till-Plowdown	10	6-Month	4.20	13.78	25.67	17.98	43.65	0.32	6.89	7.21
All BMPs-Plowdown	10	6-Month	3.91	4.40	26.77	8.31	35.09	0.30	2.20	2.50
No-Till-Topdress	10	6-Month	6.19	9.17	18.86	15.36	34.21	1.04	4.58	5.62
No BMPs-Plowdown	10	12-Month	4.16	24.84	19.33	29.00	48.33	0.23	12.42	12.65
Terraces-Plowdown	10	12-Month	3.88	9.47	20.32	13.35	33.66	0.21	4.73	4.95
Reduced Till-Plowdown	10	12-Month	3.59	13.78	19.74	17.37	37.11	0.24	6.89	7.13
All BMPs-Plowdown	10	12-Month	3.50	4.40	21.05	7.89	28.95	0.23	2.20	2.43
No-Till-Topdress	10	12-Month	5.60	9.17	11.72	14.77	26.49	0.99	4.58	5.57
No BMPs-Injection	10	12-Month	4.38	24.84	13.01	29.22	42.23	0.24	12.42	12.66
Terraces-Injection	10	12-Month	4.13	9.47	13.91	13.60	27.51	0.23	4.73	4.96
Reduced Till-Injection	10	12-Month	3.78	13.78	13.70	17.56	31.26	0.25	6.89	7.14
All BMPs-Injection	10	12-Month	3.79	4.40	13.88	8.19	22.07	0.25	2.20	2.45
No-Till-Injection	10	12-Month	4.82	9.17	10.40	13.99	24.39	0.91	4.58	5.49

Table B10 -- CREAMS Estimates of Nutrient Losses (lbs/acre) for Corn Silage Following Alfalfa on a 5 Percent Slope

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs	40	Daily	13.49	54.39	63.75	67.88	131.64	2.15	28.28	30.44
Terraces	40	Daily	12.38	20.09	67.75	32.47	100.22	1.93	10.45	12.38
Reduced Till	40	Daily	12.02	25.76	65.41	37.78	103.19	1.92	13.40	15.32
All BMPs	40	Daily	11.23	7.85	70.07	19.08	89.15	1.78	4.08	5.86
No-Till	40	Daily	17.86	13.94	54.75	31.80	86.56	3.63	7.25	10.88
No BMPs-Plowdown	40	6-Month	10.58	54.39	74.34	64.97	139.31	0.56	28.28	28.85
Terraces-Plowdown	40	6-Month	9.77	20.09	79.64	29.86	109.51	0.52	10.45	10.97
Reduced Till-Plowdown	40	6-Month	9.48	25.76	76.68	35.24	111.92	0.55	13.40	13.94
All BMPs-Plowdown	40	6-Month	8.05	7.85	82.13	15.90	98.03	0.30	4.08	4.39
No-Till-Topdress	40	6-Month	13.57	13.94	59.10	27.51	86.62	1.58	7.25	8.84
No BMPs-Plowdown	40	12-Month	13.32	54.39	75.37	67.71	143.08	0.24	28.28	28.53
Terraces-Plowdown	40	12-Month	12.13	20.09	78.30	32.22	110.53	0.23	10.45	10.67
Reduced Till-Plowdown	40	12-Month	11.83	25.76	80.02	37.60	117.62	0.25	13.40	13.64
All BMPs-Plowdown	40	12-Month	10.74	7.85	80.68	18.59	99.27	0.23	4.08	4.31
No-Till-Topdress	40	12-Month	17.95	13.94	57.51	31.90	89.41	1.48	7.25	8.73
No BMPs-Injection	40	12-Month	18.18	54.39	93.49	72.57	166.06	0.31	28.28	28.59
Terraces-Injection	40	12-Month	16.75	20.09	99.65	36.84	136.49	0.29	10.45	10.74
Reduced Till-Injection	40	12-Month	15.93	25.76	97.59	41.69	139.28	0.29	13.40	13.69
All BMPs-Injection	40	12-Month	14.97	7.85	95.70	22.82	118.52	0.28	4.08	4.36
No-Till-Injection	40	12-Month	21.70	13.94	94.40	35.64	130.04	1.14	7.25	8.39
No BMPs	30	Daily	7.57	43.51	59.72	51.08	110.80	0.51	21.76	22.27
Terraces	30	Daily	7.07	16.07	63.10	23.14	86.24	0.48	8.04	8.52
Reduced Till	30	Daily	6.88	20.61	60.77	27.49	88.26	0.51	10.30	10.81
All BMPs	30	Daily	6.05	6.28	65.17	12.33	77.49	0.36	3.14	3.50
No-Till	30	Daily	11.48	11.16	51.05	22.64	73.68	1.86	5.58	7.43
No BMPs-Plowdown	30	6-Month	8.56	43.51	59.30	52.07	111.37	0.46	21.76	22.21
Terraces-Plowdown	30	6-Month	7.91	16.07	63.48	23.98	87.46	0.42	8.04	8.46
Reduced Till-Plowdown	30	6-Month	7.67	20.61	61.10	28.28	89.38	0.45	10.30	10.75
All BMPs-Plowdown	30	6-Month	6.55	6.28	65.49	12.83	78.33	0.26	3.14	3.40
No-Till-Topdress	30	6-Month	11.08	11.16	46.92	22.23	69.15	1.43	5.58	7.01
No BMPs-Plowdown	30	12-Month	9.32	43.51	46.86	52.83	99.69	0.22	21.76	21.98
Terraces-Plowdown	30	12-Month	8.61	16.07	49.35	24.68	74.03	0.20	8.04	8.24
Reduced Till-Plowdown	30	12-Month	8.28	20.61	50.30	28.88	79.19	0.22	10.30	10.53
All BMPs-Plowdown	30	12-Month	7.77	6.28	51.72	14.05	65.77	0.21	3.14	3.35
No-Till-Topdress	30	12-Month	12.99	11.16	34.15	24.14	58.29	1.35	5.58	6.93
No BMPs-Injection	30	12-Month	12.86	43.51	60.33	56.37	116.70	0.28	21.76	22.04
Terraces-Injection	30	12-Month	11.90	16.07	64.29	27.97	92.26	0.26	8.04	8.30
Reduced Till-Injection	30	12-Month	11.26	20.61	63.34	31.87	95.21	0.26	10.30	10.56
All BMPs-Injection	30	12-Month	10.74	6.28	62.03	17.02	79.05	0.26	3.14	3.40
No-Till-Injection	30	12-Month	15.65	11.16	61.84	26.81	88.65	1.10	5.58	6.68
No BMPs	20	Daily	5.71	32.64	39.67	38.34	78.01	0.34	17.41	17.75
Terraces	20	Daily	5.37	12.05	41.64	17.42	59.06	0.33	6.43	6.75
Reduced Till	20	Daily	5.17	15.46	40.24	20.62	60.86	0.34	8.24	8.59
All BMPs	20	Daily	4.89	4.71	43.26	9.60	52.86	0.31	2.51	2.83
No-Till	20	Daily	9.19	8.37	31.14	17.56	48.70	1.65	4.46	6.11
No BMPs-Plowdown	20	6-Month	6.47	32.64	43.74	39.10	82.85	0.37	17.41	17.77
Terraces-Plowdown	20	6-Month	5.98	12.05	46.75	18.03	64.78	0.34	6.43	6.77
Reduced Till-Plowdown	20	6-Month	5.81	15.46	44.98	21.26	66.24	0.36	8.24	8.60
All BMPs-Plowdown	20	6-Month	5.00	4.71	48.27	9.71	57.98	0.23	2.51	2.74
No-Till-Topdress	20	6-Month	8.52	8.37	34.26	16.88	51.14	1.25	4.46	5.71

Table B10 — (Continued.)

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs-Plowdown	20	12-Month	6.93	32.64	34.77	39.56	74.33	0.21	17.41	17.61
Terraces-Plowdown	20	12-Month	6.44	12.05	37.31	18.49	55.80	0.19	6.43	6.62
Reduced Till-Plowdown	20	12-Month	6.11	15.46	36.18	21.56	57.75	0.21	8.24	8.45
All BMPs-Plowdown	20	12-Month	5.80	4.71	38.92	10.51	49.43	0.20	2.51	2.71
No-Till-Topdress	20	12-Month	9.06	8.37	19.81	17.43	37.24	1.19	4.46	5.66
No BMPs-Injection	20	12-Month	7.53	32.64	26.82	40.17	66.99	0.25	17.41	17.66
Terraces-Injection	20	12-Month	7.11	12.05	29.43	19.16	48.59	0.24	6.43	6.67
Reduced Till-Injection	20	12-Month	6.62	15.46	28.82	22.08	50.90	0.24	8.24	8.48
All BMPs-Injection	20	12-Month	6.64	4.71	29.83	11.35	41.18	0.23	2.51	2.74
No-Till-Injection	20	12-Month	9.41	8.37	28.15	17.78	45.93	1.03	4.46	5.49
No BMPs	15	Daily	4.85	21.76	32.90	26.61	59.50	0.31	10.88	11.19
Terraces	15	Daily	4.55	8.04	34.54	12.59	47.13	0.30	4.02	4.32
Reduced Till	15	Daily	4.39	10.30	33.35	14.70	48.04	0.33	5.15	5.48
All BMPs	15	Daily	4.14	3.14	35.88	7.28	43.16	0.31	1.57	1.88
No-Till	15	Daily	7.74	5.58	25.58	13.32	38.90	1.39	2.79	4.18
No BMPs-Plowdown	15	6-Month	5.42	21.76	35.96	27.18	63.14	0.33	10.88	11.21
Terraces-Plowdown	15	6-Month	5.02	8.04	38.38	13.05	51.43	0.31	4.02	4.33
Reduced Till-Plowdown	15	6-Month	4.87	10.30	36.91	15.18	52.09	0.34	5.15	5.50
All BMPs-Plowdown	15	6-Month	4.22	3.14	39.65	7.36	47.01	0.25	1.57	1.82
No-Till-Topdress	15	6-Month	7.23	5.58	27.92	12.81	40.73	1.09	2.79	3.88
No BMPs-Plowdown	15	12-Month	5.77	21.76	29.24	27.52	56.76	0.19	10.88	11.07
Terraces-Plowdown	15	12-Month	5.36	8.04	31.31	13.40	44.70	0.18	4.02	4.20
Reduced Till-Plowdown	15	12-Month	5.10	10.30	30.32	15.40	45.73	0.20	5.15	5.35
All BMPs-Plowdown	15	12-Month	4.82	3.14	32.65	7.96	40.61	0.18	1.57	1.75
No-Till-Topdress	15	12-Month	7.64	5.58	17.09	13.22	30.31	1.01	2.79	3.80
No BMPs-Injection	15	12-Month	6.16	21.76	23.27	27.92	51.19	0.22	10.88	11.10
Terraces-Injection	15	12-Month	5.82	8.04	25.40	13.86	39.26	0.21	4.02	4.23
Reduced Till-Injection	15	12-Month	5.43	10.30	24.78	15.73	40.51	0.21	5.15	5.36
All BMPs-Injection	15	12-Month	5.42	3.14	25.73	8.56	34.29	0.20	1.57	1.77
No-Till-Injection	15	12-Month	7.36	5.58	18.74	12.94	31.68	0.89	2.79	3.68
No BMPs	10	Daily	4.75	21.76	28.72	26.51	55.23	0.28	10.88	11.16
Terraces	10	Daily	4.45	8.04	30.30	12.48	42.78	0.26	4.02	4.28
Reduced Till	10	Daily	4.29	10.30	29.27	14.59	43.86	0.30	5.15	5.45
All BMPs	10	Daily	4.04	3.14	31.52	7.18	38.71	0.28	1.57	1.85
No-Till	10	Daily	7.25	5.58	21.64	12.83	34.47	1.22	2.79	4.01
No BMPs-Plowdown	10	6-Month	4.85	21.76	29.44	26.60	56.04	0.29	10.88	11.17
Terraces-Plowdown	10	6-Month	4.49	8.04	31.41	12.52	43.94	0.27	4.02	4.29
Reduced Till-Plowdown	10	6-Month	4.36	10.30	30.23	14.66	44.90	0.30	5.15	5.46
All BMPs-Plowdown	10	6-Month	3.86	3.14	32.53	7.00	39.52	0.24	1.57	1.81
No-Till-Topdress	10	6-Month	6.71	5.58	22.86	12.29	35.15	1.02	2.79	3.81
No BMPs-Plowdown	10	12-Month	4.61	21.76	23.70	26.36	50.06	0.21	10.88	11.09
Terraces-Plowdown	10	12-Month	4.28	8.04	25.29	12.32	37.61	0.20	4.02	4.21
Reduced Till-Plowdown	10	12-Month	4.09	10.30	24.45	14.40	38.85	0.23	5.15	5.38
All BMPs-Plowdown	10	12-Month	3.84	3.14	26.37	6.98	33.35	0.22	1.57	1.79
No-Till-Topdress	10	12-Month	6.38	5.58	14.64	11.96	26.60	1.00	2.79	3.79
No BMPs-Injection	10	12-Month	4.93	21.76	19.17	26.69	45.86	0.23	10.88	11.11
Terraces-Injection	10	12-Month	4.63	8.04	20.39	12.67	33.06	0.22	4.02	4.24
Reduced Till-Injection	10	12-Month	4.36	10.30	19.88	14.66	34.54	0.25	5.15	5.40
All BMPs-Injection	10	12-Month	4.29	3.14	20.74	7.43	28.17	0.24	1.57	1.81
No-Till-Injection	10	12-Month	6.12	5.58	14.51	11.70	26.21	0.92	2.79	3.71

Table B11 -- CREAMS Estimates of Nutrient Losses (lbs/acre) for Corn Silage Following Corn Grain on a 5 Percent Slope

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs	40	Daily	13.58	66.54	53.96	80.11	134.07	2.60	34.60	37.20
Terraces	40	Daily	12.54	24.23	57.08	36.78	93.86	2.36	12.60	14.96
Reduced Till	40	Daily	12.34	33.59	54.99	45.92	100.92	2.35	17.47	19.81
All BMPs	40	Daily	11.48	9.67	59.20	21.15	80.35	2.16	5.03	7.19
No-Till	40	Daily	15.72	22.73	49.60	38.44	88.05	3.89	11.82	15.71
No BMPs-Plowdown	40	6-Month	9.35	66.54	66.28	75.88	142.17	0.59	34.60	35.19
Terraces-Plowdown	40	6-Month	8.67	24.23	70.66	32.90	103.56	0.54	12.60	13.15
Reduced Till-Plowdown	40	6-Month	8.54	33.59	67.84	42.13	109.97	0.57	17.47	18.04
All BMPs-Plowdown	40	6-Month	7.17	9.67	72.99	16.84	89.83	0.33	5.03	5.36
No-Till-Topdress	40	6-Month	10.95	22.73	54.22	33.68	87.90	1.67	11.82	13.49
No BMPs-Plowdown	40	12-Month	9.23	66.54	49.57	75.76	125.34	0.27	34.60	34.87
Terraces-Plowdown	40	12-Month	8.59	24.23	53.06	32.82	85.88	0.25	12.60	12.85
Reduced Till-Plowdown	40	12-Month	8.18	33.59	51.72	41.77	93.49	0.27	17.47	17.74
All BMPs-Plowdown	40	12-Month	7.93	9.67	55.74	17.60	73.33	0.26	5.03	5.28
No-Till-Topdress	40	12-Month	12.07	22.73	24.39	34.80	59.19	1.62	11.82	13.44
No BMPs-Injection	40	12-Month	15.29	66.54	62.19	81.83	144.02	0.32	34.60	34.92
Terraces-Injection	40	12-Month	14.18	24.23	66.47	38.41	104.88	0.30	12.60	12.90
Reduced Till-Injection	40	12-Month	13.43	33.59	64.96	47.02	111.98	0.30	17.47	17.77
All BMPs-Injection	40	12-Month	12.86	9.67	63.70	22.53	86.23	0.29	5.03	5.32
No-Till-Injection	40	12-Month	16.39	22.73	63.06	39.12	102.18	1.16	11.82	12.98
No BMPs	30	Daily	7.65	53.23	49.95	60.88	110.82	0.96	26.61	27.57
Terraces	30	Daily	7.22	19.39	52.46	26.61	79.07	0.91	9.69	10.60
Reduced Till	30	Daily	7.19	26.87	50.38	34.06	84.44	0.93	13.43	14.36
All BMPs	30	Daily	6.29	7.74	54.31	14.03	68.34	0.74	3.87	4.61
No-Till	30	Daily	9.35	18.18	45.89	27.53	73.42	2.12	9.09	11.21
No BMPs-Plowdown	30	6-Month	7.15	53.23	50.66	60.37	111.03	0.48	26.61	27.10
Terraces-Plowdown	30	6-Month	6.63	19.39	53.90	26.02	79.92	0.44	9.69	10.14
Reduced Till-Plowdown	30	6-Month	6.56	26.87	51.71	33.43	85.13	0.47	13.43	13.90
All BMPs-Plowdown	30	6-Month	5.49	7.74	55.69	13.23	68.91	0.28	3.87	4.15
No-Till-Topdress	30	6-Month	8.37	18.18	41.72	26.55	68.27	1.50	9.09	10.59
No BMPs-Plowdown	30	12-Month	7.05	53.23	38.08	60.28	98.36	0.24	26.61	26.86
Terraces-Plowdown	30	12-Month	6.56	19.39	40.66	25.95	66.60	0.23	9.69	9.92
Reduced Till-Plowdown	30	12-Month	6.25	26.87	39.32	33.12	72.44	0.24	13.43	13.68
All BMPs-Plowdown	30	12-Month	6.05	7.74	42.70	13.78	56.49	0.23	3.87	4.10
No-Till-Topdress	30	12-Month	9.17	18.18	19.13	27.36	46.48	1.46	9.09	10.55
No BMPs-Injection	30	12-Month	9.48	53.23	28.70	62.71	91.41	0.28	26.61	26.89
Terraces-Injection	30	12-Month	8.85	19.39	30.83	28.24	59.07	0.26	9.69	9.95
Reduced Till-Injection	30	12-Month	8.28	26.87	30.42	35.15	65.57	0.26	13.43	13.69
All BMPs-Injection	30	12-Month	8.21	7.74	29.72	15.95	45.67	0.25	3.87	4.12
No-Till-Injection	30	12-Month	10.31	18.18	29.81	28.49	58.30	1.11	9.09	10.20
No BMPs	20	Daily	6.31	39.92	34.65	46.23	80.88	0.78	21.29	22.07
Terraces	20	Daily	5.99	14.54	36.17	20.53	56.70	0.75	7.75	8.50
Reduced Till	20	Daily	5.88	20.15	34.87	26.03	60.90	0.76	10.75	11.51
All BMPs	20	Daily	5.57	5.80	37.83	11.37	49.20	0.69	3.09	3.79
No-Till	20	Daily	8.44	13.64	27.71	22.07	49.78	1.91	7.27	9.18
No BMPs-Plowdown	20	6-Month	5.29	39.92	36.70	45.21	81.90	0.39	21.29	21.68
Terraces-Plowdown	20	6-Month	4.91	14.54	38.94	19.45	58.39	0.36	7.75	8.11
Reduced Till-Plowdown	20	6-Month	4.86	20.15	37.32	25.01	62.33	0.38	10.75	11.13
All BMPs-Plowdown	20	6-Month	4.10	5.80	40.28	9.90	50.18	0.25	3.09	3.35
No-Till-Topdress	20	6-Month	6.77	13.64	30.42	20.41	50.83	1.30	7.27	8.57

Table B11 -- (Continued.)

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs-Plowdown	20	12-Month	4.80	39.92	26.10	44.72	70.83	0.23	21.29	21.52
Terraces-Plowdown	20	12-Month	4.47	14.54	27.73	19.01	46.74	0.21	7.75	7.97
Reduced Till-Plowdown	20	12-Month	4.29	20.15	26.74	24.45	51.19	0.23	10.75	10.98
All BMPs-Plowdown	20	12-Month	4.11	5.80	29.12	9.91	39.03	0.22	3.09	3.31
No-Till-Topdress	20	12-Month	6.24	13.64	13.62	19.87	33.50	1.27	7.27	8.55
No BMPs-Injection	20	12-Month	5.89	39.92	16.30	45.81	62.11	0.25	21.29	21.54
Terraces-Injection	20	12-Month	5.56	14.54	18.02	20.10	38.12	0.24	7.75	7.99
Reduced Till-Injection	20	12-Month	5.21	20.15	17.65	25.36	43.01	0.24	10.75	10.99
All BMPs-Injection	20	12-Month	5.27	5.80	18.36	11.07	29.43	0.23	3.09	3.32
No-Till-Injection	20	12-Month	6.26	13.64	15.78	19.90	35.68	1.04	7.27	8.31
No BMPs	15	Daily	5.82	26.61	30.70	32.43	63.13	0.65	13.31	13.96
Terraces	15	Daily	5.50	9.69	32.15	15.20	47.35	0.62	4.85	5.46
Reduced Till	15	Daily	5.39	13.43	30.99	18.83	49.82	0.65	6.72	7.37
All BMPs	15	Daily	5.12	3.87	33.66	8.99	42.65	0.60	1.93	2.53
No-Till	15	Daily	7.81	9.09	23.73	16.91	40.64	1.59	4.55	6.14
No BMPs-Plowdown	15	6-Month	5.05	26.61	32.23	31.67	63.90	0.35	13.31	13.66
Terraces-Plowdown	15	6-Month	4.69	9.69	34.23	14.39	48.61	0.33	4.85	5.17
Reduced Till-Plowdown	15	6-Month	4.63	13.43	32.83	18.07	50.90	0.36	6.72	7.08
All BMPs-Plowdown	15	6-Month	4.02	3.87	35.50	7.89	43.38	0.27	1.93	2.20
No-Till-Topdress	15	6-Month	6.57	9.09	25.76	15.66	41.42	1.13	4.55	5.68
No BMPs-Plowdown	15	12-Month	4.10	26.61	22.32	30.71	53.03	0.21	13.31	13.52
Terraces-Plowdown	15	12-Month	3.81	9.69	23.65	13.51	37.15	0.20	4.85	5.05
Reduced Till-Plowdown	15	12-Month	3.68	13.43	22.77	17.12	39.88	0.22	6.72	6.93
All BMPs-Plowdown	15	12-Month	3.50	3.87	24.83	7.37	32.20	0.20	1.93	2.14
No-Till-Topdress	15	12-Month	6.05	9.09	12.94	15.14	28.09	1.07	4.55	5.61
No BMPs-Injection	15	12-Month	4.51	26.61	12.77	31.12	43.89	0.23	13.31	13.54
Terraces-Injection	15	12-Month	4.26	9.69	13.99	13.95	27.94	0.22	4.85	5.07
Reduced Till-Injection	15	12-Month	4.01	13.43	13.64	17.44	31.08	0.22	6.72	6.94
All BMPs-Injection	15	12-Month	4.03	3.87	14.25	7.90	22.15	0.21	1.93	2.14
No-Till-Injection	15	12-Month	4.80	9.09	12.49	13.89	26.38	0.89	4.55	5.44
No BMPs	10	Daily	5.26	26.61	27.49	31.87	59.36	0.51	13.31	13.81
Terraces	10	Daily	4.95	9.69	28.88	14.65	43.52	0.48	4.85	5.33
Reduced Till	10	Daily	4.84	13.43	27.83	18.27	46.10	0.51	6.72	7.23
All BMPs	10	Daily	4.60	3.87	30.27	8.46	38.73	0.47	1.93	2.41
No-Till	10	Daily	7.24	9.09	19.78	16.33	36.10	1.36	4.55	5.91
No BMPs-Plowdown	10	6-Month	4.75	26.61	28.52	31.37	59.89	0.31	13.31	13.62
Terraces-Plowdown	10	6-Month	4.42	9.69	30.27	14.11	44.38	0.29	4.85	5.14
Reduced Till-Plowdown	10	6-Month	4.33	13.43	29.07	17.77	46.84	0.32	6.72	7.04
All BMPs-Plowdown	10	6-Month	3.87	3.87	31.51	7.73	39.24	0.26	1.93	2.19
No-Till-Topdress	10	6-Month	6.41	9.09	21.14	15.50	36.64	1.06	4.55	5.60
No BMPs-Plowdown	10	12-Month	4.16	26.61	21.41	30.77	52.19	0.23	13.31	13.54
Terraces-Plowdown	10	12-Month	3.87	9.69	22.71	13.56	36.27	0.22	4.85	5.06
Reduced Till-Plowdown	10	12-Month	3.74	13.43	21.88	17.18	39.06	0.25	6.72	6.97
All BMPs-Plowdown	10	12-Month	3.57	3.87	23.86	7.44	31.30	0.24	1.93	2.17
No-Till-Topdress	10	12-Month	6.03	9.09	12.58	15.12	27.70	1.05	4.55	5.59
No BMPs-Injection	10	12-Month	4.37	26.61	14.66	30.98	45.64	0.24	13.31	13.55
Terraces-Injection	10	12-Month	4.11	9.69	15.55	13.80	29.35	0.23	4.85	5.08
Reduced Till-Injection	10	12-Month	3.91	13.43	15.15	17.34	32.49	0.25	6.72	6.97
All BMPs-Injection	10	12-Month	3.87	3.87	15.94	7.74	23.68	0.24	1.93	2.17
No-Till-Injection	10	12-Month	5.08	9.09	11.29	14.17	25.46	0.93	4.55	5.48

Table B12 -- CREAMS Estimates of Nutrient Losses (lbs/acre) for Corn Silage Following Corn Silage on a 5 Percent Slope

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs	40	Daily	13.58	75.63	53.96	89.21	143.17	2.60	39.33	41.93
Terraces	40	Daily	12.54	27.62	57.08	40.16	97.24	2.36	14.36	16.72
Reduced Till	40	Daily	12.34	46.89	54.99	59.22	114.22	2.35	24.38	26.73
All BMPs	40	Daily	9.47	12.71	59.20	22.18	81.38	1.78	6.61	8.39
No-Till	40	Daily	14.93	30.48	49.03	45.41	94.44	3.63	15.85	19.48
No BMPs-Plowdown	40	6-Month	9.35	75.63	66.28	84.98	151.26	0.59	39.33	39.92
Terraces-Plowdown	40	6-Month	8.67	27.62	70.66	36.29	106.94	0.54	14.36	14.91
Reduced Till-Plowdown	40	6-Month	8.54	46.89	67.84	55.43	123.28	0.57	24.38	24.96
All BMPs-Plowdown	40	6-Month	6.27	12.71	72.99	18.98	91.97	0.30	6.61	6.91
No-Till-Topdress	40	6-Month	10.63	30.48	53.37	41.11	94.48	1.58	15.85	17.43
No BMPs-Plowdown	40	12-Month	9.23	75.63	49.57	84.86	134.43	0.27	39.33	39.60
Terraces-Plowdown	40	12-Month	8.59	27.62	53.06	36.20	89.26	0.25	14.36	14.61
Reduced Till-Plowdown	40	12-Month	8.18	46.89	51.72	55.07	106.80	0.27	24.38	24.65
All BMPs-Plowdown	40	12-Month	7.85	12.71	55.74	20.56	76.30	0.23	6.61	6.84
No-Till-Topdress	40	12-Month	12.47	30.48	30.30	42.95	73.26	1.48	15.85	17.33
No BMPs-Injection	40	12-Month	15.29	75.63	62.19	90.92	153.11	0.32	39.33	39.65
Terraces-Injection	40	12-Month	14.18	27.62	66.47	41.80	108.27	0.30	14.36	14.66
Reduced Till-Injection	40	12-Month	13.43	46.89	64.96	60.32	125.28	0.30	24.38	24.68
All BMPs-Injection	40	12-Month	12.38	12.71	63.70	25.09	88.79	0.29	6.61	6.90
No-Till-Injection	40	12-Month	16.85	30.48	67.45	47.33	114.78	1.14	15.85	16.99
No BMPs	30	Daily	7.65	60.51	49.95	68.15	118.10	0.96	30.25	31.21
Terraces	30	Daily	7.22	22.09	52.46	29.32	81.77	0.91	11.05	11.95
Reduced Till	30	Daily	7.19	37.51	50.38	44.70	95.08	0.93	18.76	19.68
All BMPs	30	Daily	4.29	10.17	54.31	14.46	68.77	0.36	5.08	5.45
No-Till	30	Daily	8.56	24.38	45.34	32.94	78.28	1.86	12.19	14.05
No BMPs-Plowdown	30	6-Month	7.15	60.51	50.66	67.65	118.31	0.48	30.25	30.73
Terraces-Plowdown	30	6-Month	6.63	22.09	53.90	28.72	82.63	0.44	11.05	11.49
Reduced Till-Plowdown	30	6-Month	6.56	37.51	51.71	44.07	95.78	0.47	18.76	19.23
All BMPs-Plowdown	30	6-Month	4.78	10.17	55.69	14.95	70.63	0.26	5.08	5.35
No-Till-Topdress	30	6-Month	8.16	24.38	41.09	32.54	73.63	1.43	12.19	13.62
No BMPs-Plowdown	30	12-Month	7.05	60.51	38.08	67.55	105.64	0.24	30.25	30.49
Terraces-Plowdown	30	12-Month	6.56	22.09	40.66	28.65	69.31	0.23	11.05	11.27
Reduced Till-Plowdown	30	12-Month	6.25	37.51	39.32	43.76	83.08	0.24	18.76	19.00
All BMPs-Plowdown	30	12-Month	5.94	10.17	42.70	16.11	58.81	0.21	5.08	5.29
No-Till-Topdress	30	12-Month	8.98	24.38	19.17	33.37	52.54	1.35	12.19	13.54
No BMPs-Injection	30	12-Month	9.48	60.51	28.70	69.99	98.69	0.28	30.25	30.53
Terraces-Injection	30	12-Month	8.85	22.09	30.83	30.94	61.77	0.26	11.05	11.31
Reduced Till-Injection	30	12-Month	8.28	37.51	30.42	45.79	76.21	0.26	18.76	19.02
All BMPs-Injection	30	12-Month	8.19	10.17	29.72	18.36	48.08	0.24	5.08	5.32
No-Till-Injection	30	12-Month	10.89	24.38	34.72	35.27	69.99	1.10	12.19	13.29
No BMPs	20	Daily	6.31	45.38	34.65	51.69	86.34	0.78	24.20	24.98
Terraces	20	Daily	5.99	16.57	36.17	22.56	58.73	0.75	8.84	9.58
Reduced Till	20	Daily	5.88	28.13	34.87	34.01	68.88	0.76	15.00	15.77
All BMPs	20	Daily	3.98	7.63	37.83	11.60	49.44	0.31	4.07	4.38
No-Till	20	Daily	7.71	18.29	27.63	26.00	53.63	1.65	9.75	11.40
No BMPs-Plowdown	20	6-Month	5.29	45.38	36.70	50.67	87.36	0.39	24.20	24.59
Terraces-Plowdown	20	6-Month	4.91	16.57	38.94	21.48	60.42	0.36	8.84	9.20
Reduced Till-Plowdown	20	6-Month	4.86	28.13	37.32	33.00	70.31	0.38	15.00	15.38
All BMPs-Plowdown	20	6-Month	3.59	7.63	40.28	11.22	51.50	0.23	4.07	4.30
No-Till-Topdress	20	6-Month	6.63	18.29	30.04	24.92	54.96	1.25	9.75	11.00

Table B12 --(Continued.)

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs-Plowdown	20	12-Month	4.80	45.38	26.10	50.18	76.28	0.23	24.20	24.43
Terraces-Plowdown	20	12-Month	4.47	16.57	27.73	21.04	48.77	0.21	8.84	9.05
Reduced Till-Plowdown	20	12-Month	4.29	28.13	26.74	32.43	59.17	0.23	15.00	15.23
All BMPs-Plowdown	20	12-Month	4.00	7.63	29.12	11.63	40.75	0.20	4.07	4.26
No-Till-Topdress	20	12-Month	6.15	18.29	13.69	24.44	38.13	1.19	9.75	10.95
No BMPs-Injection	20	12-Month	5.89	45.38	16.30	51.27	67.57	0.25	24.20	24.45
Terraces-Injection	20	12-Month	5.56	16.57	18.02	22.13	40.15	0.24	8.84	9.08
Reduced Till-Injection	20	12-Month	5.21	28.13	17.65	33.34	50.99	0.24	15.00	15.24
All BMPs-Injection	20	12-Month	5.13	7.63	18.36	12.76	31.12	0.23	4.07	4.30
No-Till-Injection	20	12-Month	6.35	18.29	15.82	24.64	40.46	1.03	9.75	10.78
No BMPs	15	Daily	5.82	30.25	30.70	36.07	66.77	0.65	15.13	15.77
Terraces	15	Daily	5.50	11.05	32.15	16.55	48.70	0.62	5.52	6.14
Reduced Till	15	Daily	5.39	18.76	30.99	24.15	55.14	0.65	9.38	10.03
All BMPs	15	Daily	3.90	5.08	33.66	8.99	42.65	0.31	2.54	2.85
No-Till	15	Daily	7.26	12.19	23.71	19.46	43.16	1.39	6.10	7.49
No BMPs-Plowdown	15	6-Month	5.05	30.25	32.23	35.31	67.54	0.35	15.13	15.48
Terraces-Plowdown	15	6-Month	4.69	11.05	34.23	15.74	49.97	0.33	5.52	5.85
Reduced Till-Plowdown	15	6-Month	4.63	18.76	32.83	23.39	56.22	0.36	9.38	9.74
All BMPs-Plowdown	15	6-Month	3.61	5.08	35.50	8.70	44.19	0.25	2.54	2.79
No-Till-Topdress	15	6-Month	6.45	12.19	25.51	18.65	44.16	1.09	6.10	7.19
No BMPs-Plowdown	15	12-Month	4.10	30.25	22.32	34.35	56.67	0.21	15.13	15.34
Terraces-Plowdown	15	12-Month	3.81	11.05	23.65	14.86	38.51	0.20	5.52	5.72
Reduced Till-Plowdown	15	12-Month	3.68	18.76	22.77	22.44	45.21	0.22	9.38	9.59
All BMPs-Plowdown	15	12-Month	3.40	5.08	24.83	8.48	33.31	0.18	2.54	2.73
No-Till-Topdress	15	12-Month	5.97	12.19	13.03	18.16	31.19	1.01	6.10	7.10
No BMPs-Injection	15	12-Month	4.51	30.25	12.77	34.76	47.53	0.23	15.13	15.36
Terraces-Injection	15	12-Month	4.26	11.05	13.99	15.31	29.30	0.22	5.52	5.74
Reduced Till-Injection	15	12-Month	4.01	18.76	13.64	22.77	36.41	0.22	9.38	9.60
All BMPs-Injection	15	12-Month	3.90	5.08	14.25	8.98	23.23	0.22	2.54	2.76
No-Till-Injection	15	12-Month	4.90	12.19	12.55	17.09	29.64	0.89	6.10	6.99
No BMPs	10	Daily	5.26	30.25	27.49	35.51	63.00	0.51	15.13	15.63
Terraces	10	Daily	4.95	11.05	28.88	16.00	44.88	0.48	5.52	6.00
Reduced Till	10	Daily	4.84	18.76	27.83	23.59	51.42	0.51	9.38	9.89
All BMPs	10	Daily	3.76	5.08	30.27	8.84	39.11	0.28	2.54	2.82
No-Till	10	Daily	6.84	12.19	19.80	19.04	38.84	1.22	6.10	7.32
No BMPs-Plowdown	10	6-Month	4.75	30.25	28.52	35.01	63.53	0.31	15.13	15.44
Terraces-Plowdown	10	6-Month	4.42	11.05	30.27	15.46	45.74	0.29	5.52	5.81
Reduced Till-Plowdown	10	6-Month	4.33	18.76	29.07	23.09	52.16	0.32	9.38	9.70
All BMPs-Plowdown	10	6-Month	3.57	5.08	31.51	8.65	40.16	0.24	2.54	2.78
No-Till-Topdress	10	6-Month	6.31	12.19	21.01	18.50	39.51	1.02	6.10	7.12
No BMPs-Plowdown	10	12-Month	4.16	30.25	21.41	34.41	55.83	0.23	15.13	15.36
Terraces-Plowdown	10	12-Month	3.87	11.05	22.71	14.92	37.63	0.22	5.52	5.74
Reduced Till-Plowdown	10	12-Month	3.74	18.76	21.88	22.50	44.38	0.25	9.38	9.63
All BMPs-Plowdown	10	12-Month	3.47	5.08	23.86	8.55	32.42	0.22	2.54	2.76
No-Till-Topdress	10	12-Month	5.96	12.19	12.68	18.16	30.83	1.00	6.10	7.10
No BMPs-Injection	10	12-Month	4.37	30.25	14.66	34.62	49.28	0.24	15.13	15.37
Terraces-Injection	10	12-Month	4.11	11.05	15.55	15.16	30.71	0.23	5.52	5.75
Reduced Till-Injection	10	12-Month	3.91	18.76	15.15	22.67	37.82	0.24	9.38	9.62
All BMPs-Injection	10	12-Month	3.76	5.08	15.94	8.84	24.78	0.23	2.54	2.77
No-Till-Injection	10	12-Month	5.13	12.19	11.35	17.32	28.67	0.92	6.10	7.02

Table B13 -- CREAMS Estimates of Nutrient Losses (lbs/acre) for Corn Grain Following Alfalfa on a 9 Percent Slope

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs	40	Daily	18.11	95.89	59.64	114.00	173.63	3.21	49.86	53.08
Terraces	40	Daily	13.34	33.42	63.91	46.76	110.67	2.09	17.38	19.47
Reduced Till	40	Daily	13.04	37.69	62.12	50.73	112.85	2.09	19.60	21.69
All BMPs	40	Daily	12.72	14.42	64.62	27.14	91.76	2.08	7.50	9.58
No-Till	40	Daily	21.89	23.27	52.95	45.17	98.11	4.69	12.10	16.80
No BMPs-Plowdown	40	6-Month	12.64	95.89	68.54	108.53	177.08	0.65	49.86	50.51
Terraces-Plowdown	40	6-Month	10.37	33.42	71.68	43.79	115.47	0.53	17.38	17.91
Reduced Till-Plowdown	40	6-Month	10.25	37.69	70.75	47.93	118.68	0.58	19.60	20.17
All BMPs-Plowdown	40	6-Month	9.62	14.42	72.21	24.03	96.25	0.55	7.50	8.05
No-Till-Topdress	40	6-Month	17.67	23.27	56.80	40.94	97.74	2.43	12.10	14.53
No BMPs-Plowdown	40	12-Month	15.44	95.89	83.72	111.33	195.05	0.26	49.86	50.13
Terraces-Plowdown	40	12-Month	13.04	33.42	85.42	46.46	131.88	0.22	17.38	17.60
Reduced Till-Plowdown	40	12-Month	12.88	37.69	88.15	50.57	138.71	0.25	19.60	19.84
All BMPs-Plowdown	40	12-Month	11.80	14.42	86.62	26.22	112.84	0.24	7.50	7.74
No-Till-Topdress	40	12-Month	19.39	23.27	61.74	42.67	104.40	1.50	12.10	13.60
No BMPs-Injection	40	12-Month	20.44	95.89	98.69	116.43	215.12	0.32	49.86	50.18
Terraces-Injection	40	12-Month	17.22	33.42	102.09	50.64	152.73	0.30	17.38	17.68
Reduced Till-Injection	40	12-Month	16.50	37.69	101.15	54.19	155.34	0.30	19.60	19.90
All BMPs-Injection	40	12-Month	15.88	14.42	94.30	30.30	124.60	0.30	7.50	7.80
No-Till-Injection	40	12-Month	23.09	23.27	95.64	46.36	142.00	1.16	12.10	13.26
No BMPs	30	Daily	12.15	76.71	55.60	88.86	144.47	1.57	38.36	39.93
Terraces	30	Daily	8.01	26.74	59.28	34.75	94.02	0.64	13.37	14.01
Reduced Till	30	Daily	7.87	30.15	57.48	38.02	95.50	0.67	15.07	15.75
All BMPs	30	Daily	7.53	11.53	59.74	19.06	78.81	0.66	5.77	6.43
No-Till	30	Daily	15.15	18.62	46.98	33.77	80.74	2.92	9.31	12.23
No BMPs-Plowdown	30	6-Month	10.19	76.71	54.57	86.91	141.48	0.52	38.36	38.88
Terraces-Plowdown	30	6-Month	8.40	26.74	57.08	35.14	92.22	0.43	13.37	13.80
Reduced Till-Plowdown	30	6-Month	8.23	30.15	55.46	38.38	93.84	0.47	15.07	15.54
All BMPs-Plowdown	30	6-Month	7.79	11.53	57.56	19.33	76.88	0.45	5.77	6.22
No-Till-Topdress	30	6-Month	13.66	18.62	41.48	32.28	73.76	2.07	9.31	11.38
No BMPs-Plowdown	30	12-Month	11.20	76.71	57.02	87.91	144.93	0.24	38.36	38.59
Terraces-Plowdown	30	12-Month	9.63	26.74	58.13	36.37	94.50	0.20	13.37	13.57
Reduced Till-Plowdown	30	12-Month	9.51	30.15	60.56	39.66	100.22	0.22	15.07	15.30
All BMPs-Plowdown	30	12-Month	8.70	11.53	59.25	20.24	79.49	0.22	5.77	5.99
No-Till-Topdress	30	12-Month	14.38	18.62	40.66	33.00	73.66	1.37	9.31	10.68
No BMPs-Injection	30	12-Month	14.80	76.71	68.27	91.51	159.78	0.28	38.36	38.64
Terraces-Injection	30	12-Month	12.64	26.74	70.66	39.38	110.04	0.26	13.37	13.63
Reduced Till-Injection	30	12-Month	12.08	30.15	70.33	42.23	112.56	0.26	15.07	15.33
All BMPs-Injection	30	12-Month	11.63	11.53	65.21	23.16	88.37	0.26	5.77	6.03
No-Till-Injection	30	12-Month	16.96	18.62	66.10	35.58	101.68	1.12	9.31	10.43
No BMPs	20	Daily	9.51	57.53	37.76	67.04	104.80	1.37	30.68	32.05
Terraces	20	Daily	6.12	20.05	41.02	26.17	67.20	0.48	10.69	11.17
Reduced Till	20	Daily	5.94	22.61	39.79	28.55	68.34	0.50	12.06	12.56
All BMPs	20	Daily	5.73	8.65	41.86	14.38	56.24	0.49	4.61	5.11
No-Till	20	Daily	11.24	13.96	29.65	25.21	54.85	2.30	7.45	9.75
No BMPs-Plowdown	20	6-Month	7.69	57.53	40.14	65.23	105.37	0.41	30.68	31.10
Terraces-Plowdown	20	6-Month	6.37	20.05	41.99	26.42	68.42	0.34	10.69	11.04
Reduced Till-Plowdown	20	6-Month	6.24	22.61	40.78	28.85	69.63	0.37	12.06	12.43
All BMPs-Plowdown	20	6-Month	5.91	8.65	42.39	14.56	56.95	0.36	4.61	4.98
No-Till-Topdress	20	6-Month	10.28	13.96	30.13	24.25	54.38	1.68	7.45	9.13

Table B13-- (Continued.)

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs-Plowdown	20	12-Month	7.40	57.53	33.34	64.94	98.28	0.22	30.68	30.91
Terraces-Plowdown	20	12-Month	6.65	20.05	35.68	26.71	62.39	0.19	10.69	10.88
Reduced Till-Plowdown	20	12-Month	6.37	22.61	34.77	28.99	63.75	0.21	12.06	12.27
All BMPs-Plowdown	20	12-Month	6.08	8.65	36.97	14.73	51.70	0.21	4.61	4.82
No-Till-Topdress	20	12-Month	9.26	13.96	18.43	23.22	41.66	1.21	7.45	8.66
No BMPs-Injection	20	12-Month	9.03	57.53	36.96	66.56	103.52	0.25	30.68	30.93
Terraces-Injection	20	12-Month	7.95	20.05	38.30	28.00	66.30	0.24	10.69	10.93
Reduced Till-Injection	20	12-Month	7.59	22.61	38.66	30.20	68.86	0.24	12.06	12.30
All BMPs-Injection	20	12-Month	7.34	8.65	35.31	15.99	51.30	0.24	4.61	4.85
No-Till-Injection	20	12-Month	10.61	13.96	35.64	24.57	60.21	1.04	7.45	8.29
No BMPs	15	Daily	7.80	38.36	31.14	46.16	77.29	1.09	19.18	20.27
Terraces	15	Daily	5.17	13.37	33.71	18.54	52.25	0.41	6.68	7.09
Reduced Till	15	Daily	5.02	15.07	32.69	20.09	52.79	0.45	7.54	7.98
All BMPs	15	Daily	4.83	5.77	34.40	10.60	45.00	0.44	2.88	3.33
No-Till	15	Daily	9.31	9.31	24.08	18.62	42.70	1.88	4.65	6.54
No BMPs-Plowdown	15	6-Month	6.44	38.36	32.93	44.80	77.73	0.37	19.18	19.55
Terraces-Plowdown	15	6-Month	5.36	13.37	34.45	18.72	53.17	0.31	6.68	6.99
Reduced Till-Plowdown	15	6-Month	5.24	15.07	33.44	20.32	53.76	0.36	7.54	7.89
All BMPs-Plowdown	15	6-Month	4.97	5.77	34.81	10.73	45.54	0.35	2.88	3.23
No-Till-Topdress	15	6-Month	8.59	9.31	24.44	17.90	42.35	1.42	4.65	6.07
No BMPs-Plowdown	15	12-Month	6.23	38.36	27.83	44.58	72.42	0.21	19.18	19.39
Terraces-Plowdown	15	12-Month	5.57	13.37	29.72	18.94	48.66	0.18	6.68	6.86
Reduced Till-Plowdown	15	12-Month	5.34	15.07	28.94	20.42	49.36	0.20	7.54	7.73
All BMPs-Plowdown	15	12-Month	5.09	5.77	30.75	10.86	41.61	0.19	2.88	3.08
No-Till-Topdress	15	12-Month	7.81	9.31	15.51	17.12	32.63	1.02	4.65	5.68
No BMPs-Injection	15	12-Month	6.69	38.36	35.67	45.05	80.72	0.23	19.18	19.41
Terraces-Injection	15	12-Month	6.00	13.37	23.85	19.37	43.22	0.21	6.68	6.89
Reduced Till-Injection	15	12-Month	5.66	15.07	23.43	20.73	44.16	0.22	7.54	7.76
All BMPs-Injection	15	12-Month	5.66	5.77	23.92	11.43	35.35	0.22	2.88	3.10
No-Till-Injection	15	12-Month	7.82	9.31	20.70	17.13	37.83	0.90	4.65	5.55
No BMPs	10	Daily	6.24	38.36	24.81	44.60	69.40	0.79	19.18	19.97
Terraces	10	Daily	4.35	13.37	26.74	17.72	44.46	0.34	6.68	7.02
Reduced Till	10	Daily	4.23	15.07	25.93	19.30	45.23	0.37	7.54	7.91
All BMPs	10	Daily	4.06	5.77	27.30	9.83	37.13	0.37	2.88	3.25
No-Till	10	Daily	7.54	9.31	18.79	16.85	35.64	1.55	4.65	6.21
No BMPs-Plowdown	10	6-Month	5.20	38.36	25.72	43.55	69.27	0.32	19.18	19.50
Terraces-Plowdown	10	6-Month	4.34	13.37	26.91	17.71	44.62	0.27	6.68	6.95
Reduced Till-Plowdown	10	6-Month	4.25	15.07	26.11	19.32	45.43	0.31	7.54	7.85
All BMPs-Plowdown	10	6-Month	4.02	5.77	27.23	9.79	37.02	0.30	2.88	3.19
No-Till-Topdress	10	6-Month	6.90	9.31	18.77	16.21	34.98	1.24	4.65	5.90
No BMPs-Plowdown	10	12-Month	5.05	38.36	22.32	43.40	65.72	0.23	19.18	19.41
Terraces-Plowdown	10	12-Month	4.48	13.37	23.75	17.85	41.60	0.19	6.68	6.88
Reduced Till-Plowdown	10	12-Month	4.31	15.07	23.10	19.39	42.49	0.23	7.54	7.77
All BMPs-Plowdown	10	12-Month	4.11	5.77	24.52	9.87	34.40	0.23	2.88	3.11
No-Till-Topdress	10	12-Month	6.38	9.31	12.81	15.69	28.50	1.02	4.65	5.67
No BMPs-Injection	10	12-Month	5.33	38.36	17.85	43.69	61.54	0.24	19.18	19.42
Terraces-Injection	10	12-Month	4.81	13.37	18.93	18.18	37.11	0.22	6.68	6.90
Reduced Till-Injection	10	12-Month	4.57	15.07	18.60	19.64	38.24	0.24	7.54	7.78
All BMPs-Injection	10	12-Month	4.53	5.77	19.03	10.30	29.33	0.24	2.88	3.12
No-Till-Injection	10	12-Month	6.21	9.31	12.62	15.52	28.14	0.93	4.65	5.58

Table B14 -- CREAMS Estimates of Nutrient Losses (lbs/acre) for Corn Grain Following Corn Grain on a 9 Percent Slope

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs	40	Daily	17.66	121.29	52.24	138.95	191.19	3.62	63.07	66.69
Terraces	40	Daily	15.20	41.79	54.82	56.99	111.82	2.97	21.73	24.70
Reduced Till	40	Daily	15.01	55.17	53.23	70.18	123.42	2.98	28.69	31.67
All BMPs	40	Daily	17.41	17.14	53.95	34.54	88.49	3.75	8.91	12.66
No-Till	40	Daily	20.49	39.20	47.26	59.69	106.94	5.20	20.38	25.59
No BMPs-Plowdown	40	6-Month	10.95	121.29	63.18	132.24	195.42	0.65	63.07	63.72
Terraces-Plowdown	40	6-Month	9.78	41.79	65.10	51.58	116.68	0.55	21.73	22.29
Reduced Till-Plowdown	40	6-Month	9.69	55.17	63.16	64.87	128.03	0.60	28.69	29.29
All BMPs-Plowdown	40	6-Month	9.78	17.14	65.25	26.92	92.17	0.59	8.91	9.50
No-Till-Topdress	40	6-Month	14.79	39.20	49.95	53.99	103.94	2.51	20.38	22.90
No BMPs-Plowdown	40	12-Month	11.55	121.29	64.86	132.84	197.70	0.27	63.07	63.34
Terraces-Plowdown	40	12-Month	10.36	41.79	65.65	52.16	117.81	0.25	21.73	21.98
Reduced Till-Plowdown	40	12-Month	10.47	55.17	68.79	65.65	134.43	0.27	28.69	28.96
All BMPs-Plowdown	40	12-Month	9.89	17.14	67.90	27.03	94.93	0.28	8.91	9.19
No-Till-Topdress	40	12-Month	14.76	39.20	40.56	53.96	94.52	1.64	20.38	22.03
No BMPs-Injection	40	12-Month	17.75	121.29	78.20	139.04	217.24	0.32	63.07	63.39
Terraces-Injection	40	12-Month	16.15	41.79	80.28	57.94	138.22	0.30	21.73	22.03
Reduced Till-Injection	40	12-Month	15.49	55.17	79.16	70.66	149.82	0.30	28.69	28.99
All BMPs-Injection	40	12-Month	15.41	17.14	72.81	32.55	105.36	0.30	8.91	9.21
No-Till-Injection	40	12-Month	18.95	39.20	76.98	58.15	135.13	1.17	20.38	21.55
No BMPs	30	Daily	11.71	97.03	48.20	108.74	156.94	1.98	48.52	50.50
Terraces	30	Daily	9.87	33.43	50.19	43.30	93.49	1.52	16.72	18.24
Reduced Till	30	Daily	9.82	44.14	48.61	53.96	102.57	1.55	22.07	23.62
All BMPs	30	Daily	12.20	13.71	49.07	25.91	74.98	2.33	6.86	9.19
No-Till	30	Daily	14.10	31.36	43.54	45.46	89.00	3.43	15.68	19.11
No BMPs-Plowdown	30	6-Month	8.49	97.03	48.50	105.53	154.03	0.53	48.52	49.04
Terraces-Plowdown	30	6-Month	7.59	33.43	49.89	41.03	90.92	0.45	16.72	17.17
Reduced Till-Plowdown	30	6-Month	7.53	44.14	48.38	51.67	100.05	0.49	22.07	22.56
All BMPs-Plowdown	30	6-Month	7.60	13.71	48.26	21.31	69.57	0.48	6.86	7.34
No-Till-Topdress	30	6-Month	11.38	31.36	38.60	42.74	81.34	2.13	15.68	17.81
No BMPs-Plowdown	30	12-Month	7.68	97.03	38.81	104.71	143.52	0.24	48.52	48.76
Terraces-Plowdown	30	12-Month	7.11	33.43	41.24	40.54	81.78	0.22	16.72	16.94
Reduced Till-Plowdown	30	12-Month	6.84	44.14	40.06	50.98	91.04	0.24	22.07	22.31
All BMPs-Plowdown	30	12-Month	6.73	13.71	42.95	20.44	63.38	0.25	6.86	7.10
No-Till-Topdress	30	12-Month	9.77	31.36	19.52	41.13	60.65	1.48	15.68	17.16
No BMPs-Injection	30	12-Month	11.94	97.03	46.99	108.97	155.96	0.28	48.52	48.80
Terraces-Injection	30	12-Month	10.93	33.43	48.38	44.36	92.74	0.26	16.72	16.98
Reduced Till-Injection	30	12-Month	10.44	44.14	47.87	54.58	102.45	0.26	22.07	22.33
All BMPs-Injection	30	12-Month	10.31	13.71	43.42	24.02	67.44	0.27	6.86	7.13
No-Till-Injection	30	12-Month	12.72	31.36	46.27	44.08	90.35	1.13	15.68	16.81
No BMPs	20	Daily	9.32	72.77	31.99	82.09	114.08	1.78	38.81	40.59
Terraces	20	Daily	7.83	25.08	33.94	32.90	66.84	1.35	13.37	14.73
Reduced Till	20	Daily	7.73	33.10	32.84	40.83	73.67	1.37	17.66	19.03
All BMPs	20	Daily	10.02	10.28	33.40	20.30	53.70	2.16	5.48	7.64
No-Till	20	Daily	10.71	23.52	26.38	34.23	60.61	2.80	12.54	15.35
No BMPs-Plowdown	20	6-Month	5.96	72.77	33.35	78.73	112.08	0.42	38.81	39.23
Terraces-Plowdown	20	6-Month	5.33	25.08	34.17	30.40	64.58	0.36	13.37	13.74
Reduced Till-Plowdown	20	6-Month	5.30	33.10	33.10	38.40	71.51	0.39	17.66	18.05
All BMPs-Plowdown	20	6-Month	5.35	10.28	34.16	15.63	49.79	0.39	5.48	5.87
No-Till-Topdress	20	6-Month	8.11	23.52	27.15	31.63	58.78	1.73	12.54	14.27

Table B14 -- (Continued.)

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs-Plowdown	20	12-Month	5.41	72.77	26.86	78.18	105.04	0.23	38.81	39.04
Terraces-Plowdown	20	12-Month	5.00	25.08	28.38	30.07	58.46	0.21	13.37	13.58
Reduced Till-Plowdown	20	12-Month	4.83	33.10	27.53	37.93	65.46	0.23	17.66	17.88
All BMPs-Plowdown	20	12-Month	4.76	10.28	29.46	15.05	44.51	0.23	5.48	5.72
No-Till-Topdress	20	12-Month	6.81	23.52	14.05	30.33	44.38	1.29	12.54	13.84
No BMPs-Injection	20	12-Month	6.42	72.77	17.13	79.19	96.32	0.26	38.81	39.07
Terraces-Injection	20	12-Month	6.03	25.08	18.73	31.11	49.84	0.25	13.37	13.62
Reduced Till-Injection	20	12-Month	5.70	33.10	18.50	38.80	57.30	0.25	17.66	17.91
All BMPs-Injection	20	12-Month	5.84	10.28	18.73	16.12	34.85	0.26	5.48	5.74
No-Till-Injection	20	12-Month	6.75	23.52	16.27	30.27	46.54	1.06	12.54	13.60
No BMPs	15	Daily	8.08	48.52	28.21	56.60	84.81	1.39	24.26	25.65
Terraces	15	Daily	6.89	16.72	29.94	23.60	53.54	1.07	8.36	9.43
Reduced Till	15	Daily	6.79	22.07	28.96	28.86	57.82	1.11	11.03	12.14
All BMPs	15	Daily	8.49	6.86	29.67	15.35	45.02	1.70	3.43	5.13
No-Till	15	Daily	9.44	15.68	22.55	25.12	47.68	2.26	7.84	10.10
No BMPs-Plowdown	15	6-Month	5.46	48.52	28.69	53.98	82.67	0.38	24.26	24.63
Terraces-Plowdown	15	6-Month	4.92	16.72	29.51	21.63	51.14	0.33	8.36	8.69
Reduced Till-Plowdown	15	6-Month	4.88	22.07	28.59	26.95	55.54	0.37	11.03	11.41
All BMPs-Plowdown	15	6-Month	4.91	6.86	29.63	11.76	41.39	0.37	3.43	3.80
No-Till-Topdress	15	6-Month	7.50	15.68	23.13	23.18	46.31	1.46	7.84	9.30
No BMPs-Plowdown	15	12-Month	4.28	48.52	20.91	52.80	73.70	0.21	24.26	24.47
Terraces-Plowdown	15	12-Month	3.95	16.72	21.98	20.67	42.65	0.20	8.36	8.55
Reduced Till-Plowdown	15	12-Month	3.83	22.07	21.29	25.90	47.19	0.21	11.03	11.25
All BMPs-Plowdown	15	12-Month	3.79	6.86	22.74	10.64	33.38	0.22	3.43	3.65
No-Till-Topdress	15	12-Month	5.76	15.68	12.03	21.44	33.47	1.09	7.84	8.93
No BMPs-Injection	15	12-Month	5.02	48.52	13.60	53.54	67.14	0.23	24.26	24.49
Terraces-Injection	15	12-Month	4.72	16.72	14.72	21.48	36.20	0.22	8.36	8.58
Reduced Till-Injection	15	12-Month	4.48	22.07	14.50	26.55	41.05	0.23	11.03	11.26
All BMPs-Injection	15	12-Month	4.59	6.86	14.66	11.45	26.11	0.23	3.43	3.66
No-Till-Injection	15	12-Month	5.29	15.68	12.99	20.97	33.96	0.91	7.84	8.75
No BMPs	10	Daily	6.78	48.52	25.16	55.30	80.46	1.00	24.26	25.25
Terraces	10	Daily	5.87	16.72	26.63	22.59	49.23	0.78	8.36	9.14
Reduced Till	10	Daily	5.77	22.07	25.79	27.84	53.63	0.81	11.03	11.85
All BMPs	10	Daily	6.89	6.86	26.71	13.75	40.46	1.20	3.43	4.63
No-Till	10	Daily	8.22	15.68	18.74	23.90	42.64	1.81	7.84	9.65
No BMPs-Plowdown	10	6-Month	5.03	48.52	25.48	53.55	79.03	0.33	24.26	24.58
Terraces-Plowdown	10	6-Month	4.56	16.72	26.37	21.28	47.65	0.29	8.36	8.65
Reduced Till-Plowdown	10	6-Month	4.50	22.07	25.54	26.57	52.11	0.33	11.03	11.37
All BMPs-Plowdown	10	6-Month	4.50	6.86	26.69	11.36	38.04	0.33	3.43	3.76
No-Till-Topdress	10	6-Month	6.92	15.68	19.12	22.60	41.73	1.28	7.84	9.12
No BMPs-Plowdown	10	12-Month	4.20	48.52	19.31	52.71	72.03	0.23	24.26	24.49
Terraces-Plowdown	10	12-Month	3.88	16.72	20.32	20.59	40.91	0.21	8.36	8.57
Reduced Till-Plowdown	10	12-Month	3.77	22.07	19.69	25.84	45.52	0.25	11.03	11.28
All BMPs-Plowdown	10	12-Month	3.73	6.86	21.02	10.58	31.60	0.25	3.43	3.68
No-Till-Topdress	10	12-Month	5.74	15.68	11.71	21.42	33.13	1.06	7.84	8.90
No BMPs-Injection	10	12-Month	4.42	48.52	12.65	52.94	65.59	0.24	24.26	24.50
Terraces-Injection	10	12-Month	4.13	16.72	13.29	20.85	34.14	0.22	8.36	8.58
Reduced Till-Injection	10	12-Month	3.95	22.07	13.07	26.02	39.09	0.24	11.03	11.27
All BMPs-Injection	10	12-Month	4.01	6.86	13.31	10.87	24.18	0.24	3.43	3.67
No-Till-Injection	10	12-Month	4.82	15.68	10.40	20.50	30.90	0.94	7.84	8.78

Table B15 --CREAMS Estimates of Nutrient Losses (lbs/acre) for Corn Grain Following Corn Silage on a 9 Percent Slope

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs	40	Daily	17.66	141.13	52.24	158.78	211.03	3.62	73.39	77.01
Terraces	40	Daily	15.20	49.14	54.82	64.34	119.17	2.97	25.55	28.52
Reduced Till	40	Daily	15.01	81.85	53.23	96.86	150.10	2.98	42.56	45.54
All BMPs	40	Daily	11.21	25.75	53.95	36.97	90.91	2.08	13.39	15.47
No-Till	40	Daily	18.93	57.33	46.98	76.26	123.24	4.69	29.81	34.51
No BMPs-Plowdown	40	6-Month	10.95	141.13	63.18	152.08	215.26	0.65	73.39	74.04
Terraces-Plowdown	40	6-Month	9.78	49.14	65.10	58.93	124.03	0.55	25.55	26.11
Reduced Till-Plowdown	40	6-Month	9.69	81.85	63.16	91.55	154.71	0.60	42.56	43.17
All BMPs-Plowdown	40	6-Month	8.08	25.75	65.25	33.83	99.08	0.55	13.39	13.95
No-Till-Topdress	40	6-Month	14.34	57.33	48.80	71.68	120.47	2.43	29.81	32.24
No BMPs-Plowdown	40	12-Month	11.55	141.13	64.86	152.68	217.54	0.27	73.39	73.65
Terraces-Plowdown	40	12-Month	10.36	49.14	65.65	59.51	125.16	0.25	25.55	25.80
Reduced Till-Plowdown	40	12-Month	10.47	81.85	68.79	92.32	161.11	0.27	42.56	42.83
All BMPs-Plowdown	40	12-Month	9.28	25.75	67.90	35.03	102.94	0.24	13.39	13.63
No-Till-Topdress	40	12-Month	14.72	57.33	43.30	72.05	115.35	1.50	29.81	31.31
No BMPs-Injection	40	12-Month	17.75	141.13	78.20	158.88	237.08	0.32	73.39	73.71
Terraces-Injection	40	12-Month	16.15	49.14	80.28	65.29	145.57	0.30	25.55	25.85
Reduced Till-Injection	40	12-Month	15.49	81.85	79.16	97.34	176.50	0.30	42.56	42.86
All BMPs-Injection	40	12-Month	13.75	25.75	72.81	39.50	112.31	0.29	13.39	13.68
No-Till-Injection	40	12-Month	18.94	57.33	77.74	76.27	154.01	1.16	29.81	30.97
No BMPs	30	Daily	11.71	112.90	48.20	124.61	172.81	1.98	56.45	58.43
Terraces	30	Daily	9.87	39.32	50.19	49.18	99.37	1.52	19.66	21.18
Reduced Till	30	Daily	9.82	65.48	48.61	75.31	123.91	1.55	32.74	34.29
All BMPs	30	Daily	6.03	20.60	49.07	26.63	75.70	0.66	10.30	10.96
No-Till	30	Daily	12.54	45.87	43.28	58.41	101.69	2.92	22.93	25.86
No BMPs-Plowdown	30	6-Month	8.49	112.90	48.50	121.40	169.90	0.53	56.45	56.98
Terraces-Plowdown	30	6-Month	7.59	39.32	49.89	46.91	96.80	0.45	19.66	20.11
Reduced Till-Plowdown	30	6-Month	7.53	65.48	48.38	73.01	121.39	0.49	32.74	33.23
All BMPs-Plowdown	30	6-Month	6.26	20.60	47.51	26.86	74.37	0.45	10.30	10.75
No-Till-Topdress	30	6-Month	11.06	45.87	37.73	56.92	94.66	2.07	22.93	25.00
No BMPs-Plowdown	30	12-Month	7.68	112.90	38.81	120.58	159.39	0.24	56.45	56.69
Terraces-Plowdown	30	12-Month	7.11	39.32	41.24	46.42	87.66	0.22	19.66	19.88
Reduced Till-Plowdown	30	12-Month	6.84	65.48	40.06	72.32	112.38	0.24	32.74	32.98
All BMPs-Plowdown	30	12-Month	6.48	20.60	42.95	27.08	70.03	0.22	10.30	10.52
No-Till-Topdress	30	12-Month	9.76	45.87	21.97	55.63	77.60	1.37	22.93	24.30
No BMPs-Injection	30	12-Month	11.94	112.90	46.99	124.84	171.83	0.28	56.45	56.73
Terraces-Injection	30	12-Month	10.93	39.32	48.38	50.25	98.63	0.26	19.66	19.92
Reduced Till-Injection	30	12-Month	10.44	65.48	47.87	75.92	123.79	0.26	32.74	33.00
All BMPs-Injection	30	12-Month	9.51	20.60	43.42	30.11	73.53	0.25	10.30	10.55
No-Till-Injection	30	12-Month	12.90	45.87	47.81	58.77	106.58	1.12	22.93	24.05
No BMPs	20	Daily	9.32	84.68	31.99	93.99	125.98	1.78	45.16	46.94
Terraces	20	Daily	7.83	29.49	33.94	37.31	71.25	1.35	15.73	17.08
Reduced Till	20	Daily	7.73	49.11	32.84	56.84	89.68	1.37	26.19	27.57
All BMPs	20	Daily	4.58	15.45	33.40	20.03	53.43	0.49	8.24	8.73
No-Till	20	Daily	9.27	34.40	26.71	43.67	70.38	2.30	18.35	20.65
No BMPs-Plowdown	20	6-Month	5.96	84.68	33.35	90.64	123.98	0.42	45.16	45.58
Terraces-Plowdown	20	6-Month	5.33	29.49	34.17	34.82	68.99	0.36	15.73	16.09
Reduced Till-Plowdown	20	6-Month	5.30	49.11	33.10	54.41	87.51	0.39	26.19	26.59
All BMPs-Plowdown	20	6-Month	4.38	15.45	34.16	19.83	53.99	0.36	8.24	8.60
No-Till-Topdress	20	6-Month	7.90	34.40	26.58	42.30	68.89	1.68	18.35	20.03

Table B15 --(Continued.)

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs-Plowdown	20	12-Month	5.41	84.68	26.86	90.08	116.94	0.23	45.16	45.39
Terraces-Plowdown	20	12-Month	5.00	29.49	28.38	34.49	62.87	0.21	15.73	15.93
Reduced Till-Plowdown	20	12-Month	4.83	49.11	27.53	53.94	81.47	0.23	26.19	26.42
All BMPs-Plowdown	20	12-Month	4.52	15.45	27.56	19.98	47.53	0.21	8.24	8.45
No-Till-Topdress	20	12-Month	6.65	34.40	14.03	41.05	55.09	1.21	18.35	19.56
No BMPs-Injection	20	12-Month	6.42	84.68	17.13	91.10	108.23	0.26	45.16	45.42
Terraces-Injection	20	12-Month	6.03	29.49	18.73	35.52	54.25	0.25	15.73	15.98
Reduced Till-Injection	20	12-Month	5.70	49.11	18.50	54.81	73.31	0.25	26.19	26.44
All BMPs-Injection	20	12-Month	5.59	15.45	18.27	21.04	39.31	0.24	8.24	8.48
No-Till-Injection	20	12-Month	6.84	34.40	16.82	41.24	58.06	1.05	18.35	19.40
No BMPs	15	Daily	8.08	56.45	28.21	64.54	92.74	1.39	28.23	29.62
Terraces	15	Daily	6.89	19.66	29.94	26.54	56.48	1.07	9.83	10.90
Reduced Till	15	Daily	6.79	32.74	28.96	39.53	68.49	1.11	16.37	17.48
All BMPs	15	Daily	4.36	10.30	29.67	14.66	44.33	0.44	5.15	5.59
No-Till	15	Daily	8.35	22.93	22.80	31.29	54.09	1.88	11.47	13.35
No BMPs-Plowdown	15	6-Month	5.46	56.45	28.69	61.91	90.60	0.38	28.23	28.60
Terraces-Plowdown	15	6-Month	4.92	19.66	29.51	24.57	54.08	0.33	9.83	10.16
Reduced Till-Plowdown	15	6-Month	4.88	32.74	28.59	37.62	66.21	0.37	16.37	16.74
All BMPs-Plowdown	15	6-Month	4.12	10.30	29.63	14.43	44.05	0.35	5.15	5.50
No-Till-Topdress	15	6-Month	7.33	22.93	22.71	30.26	52.97	1.42	11.47	12.88
No BMPs-Plowdown	15	12-Month	4.28	56.45	20.91	60.73	81.64	0.21	28.23	28.44
Terraces-Plowdown	15	12-Month	3.95	19.66	21.98	23.61	45.59	0.20	9.83	10.02
Reduced Till-Plowdown	15	12-Month	3.83	32.74	21.29	36.57	57.86	0.21	16.37	16.59
All BMPs-Plowdown	15	12-Month	3.55	10.30	22.74	13.85	36.59	0.19	5.15	5.34
No-Till-Topdress	15	12-Month	5.64	22.93	12.02	28.58	40.60	1.02	11.47	12.49
No BMPs-Injection	15	12-Month	5.02	56.45	13.60	61.47	75.07	0.23	28.23	28.46
Terraces-Injection	15	12-Month	4.72	19.66	14.72	24.38	39.10	0.22	9.83	10.05
Reduced Till-Injection	15	12-Month	4.48	32.74	14.50	37.22	51.72	0.23	16.37	16.60
All BMPs-Injection	15	12-Month	4.36	10.30	14.66	14.66	29.32	0.21	5.15	5.36
No-Till-Injection	15	12-Month	5.33	22.93	12.96	28.26	41.22	0.90	11.47	12.37
No BMPs	10	Daily	6.78	56.45	25.16	63.23	88.39	1.00	28.23	29.22
Terraces	10	Daily	5.87	19.66	26.63	25.53	52.17	0.78	9.83	10.61
Reduced Till	10	Daily	5.77	32.74	25.79	38.51	64.31	0.81	16.37	17.18
All BMPs	10	Daily	4.07	10.30	26.71	14.37	41.09	0.37	5.15	5.52
No-Till	10	Daily	7.46	22.93	18.92	30.39	49.31	1.55	11.47	13.02
No BMPs-Plowdown	10	6-Month	5.03	56.45	25.48	61.49	86.97	0.33	28.23	28.55
Terraces-Plowdown	10	6-Month	4.56	19.66	26.37	24.22	50.59	0.29	9.83	10.12
Reduced Till-Plowdown	10	6-Month	4.50	32.74	25.54	37.24	62.79	0.33	16.37	16.70
All BMPs-Plowdown	10	6-Month	3.91	10.30	26.69	14.21	40.90	0.30	5.15	5.45
No-Till-Topdress	10	6-Month	6.77	22.93	18.86	29.71	48.56	1.24	11.47	12.71
No BMPs-Plowdown	10	12-Month	4.20	56.45	19.31	60.65	79.96	0.23	28.23	28.46
Terraces-Plowdown	10	12-Month	3.88	19.66	20.32	23.53	43.85	0.21	9.83	10.04
Reduced Till-Plowdown	10	12-Month	3.77	32.74	19.69	36.51	56.20	0.25	16.37	16.62
All BMPs-Plowdown	10	12-Month	3.50	10.30	21.02	13.80	34.81	0.23	5.15	5.38
No-Till-Topdress	10	12-Month	5.63	22.93	11.72	28.57	40.29	1.02	11.47	12.48
No BMPs-Injection	10	12-Month	4.42	56.45	12.65	60.97	73.62	0.24	28.23	28.47
Terraces-Injection	10	12-Month	4.13	19.66	13.29	23.79	37.08	0.22	9.83	10.05
Reduced Till-Injection	10	12-Month	3.95	32.74	13.07	36.69	49.76	0.24	16.37	16.61
All BMPs-Injection	10	12-Month	3.79	10.30	13.31	14.09	27.40	0.23	5.15	5.38
No-Till-Injection	10	12-Month	4.84	22.93	10.40	27.77	38.17	0.93	11.47	12.40

Table B16 -- CREAMS Estimates of Nutrient Losses (lbs/acre) for Corn Silage Following Alfalfa on a 9 Percent Slope

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs	40	Daily	15.71	120.57	62.70	136.28	198.98	2.58	62.70	65.28
Terraces	40	Daily	12.38	43.54	67.75	55.92	123.67	1.93	22.64	24.57
Reduced Till	40	Daily	12.10	58.40	65.41	70.50	135.91	1.93	30.37	32.30
All BMPs	40	Daily	11.23	16.63	70.07	27.85	97.92	1.78	8.65	10.42
No-Till	40	Daily	17.86	35.01	54.75	52.87	107.62	3.63	18.21	21.83
No BMPs-Plowdown	40	6-Month	11.65	120.57	73.84	132.22	206.06	0.59	62.70	63.28
Terraces-Plowdown	40	6-Month	9.77	43.54	79.64	53.31	132.96	0.52	22.64	23.16
Reduced Till-Plowdown	40	6-Month	9.57	58.40	76.69	67.97	144.65	0.55	30.37	30.92
All BMPs-Plowdown	40	6-Month	8.05	16.63	82.13	24.68	106.81	0.30	8.65	8.95
No-Till-Topdress	40	6-Month	13.57	35.01	59.10	48.58	107.68	1.58	18.21	19.79
No BMPs-Plowdown	40	12-Month	13.99	120.57	74.75	134.56	209.30	0.27	62.70	62.96
Terraces-Plowdown	40	12-Month	12.13	43.54	78.30	55.67	133.98	0.23	22.64	22.87
Reduced Till-Plowdown	40	12-Month	11.97	58.40	80.00	70.38	150.38	0.25	30.37	30.62
All BMPs-Plowdown	40	12-Month	10.74	16.63	80.68	27.37	108.04	0.23	8.65	8.88
No-Till-Topdress	40	12-Month	17.95	35.01	57.51	52.97	110.48	1.48	18.21	19.69
No BMPs-Injection	40	12-Month	19.43	120.57	92.70	140.00	232.70	0.32	62.70	63.02
Terraces-Injection	40	12-Month	16.75	43.54	99.65	60.29	159.94	0.30	22.64	22.94
Reduced Till-Injection	40	12-Month	16.12	58.40	97.56	74.52	172.08	0.30	30.37	30.67
All BMPs-Injection	40	12-Month	14.97	16.63	95.70	31.60	127.30	0.29	8.65	8.94
No-Till-Injection	40	12-Month	21.70	35.01	94.40	56.71	151.11	1.15	18.21	19.36
No BMPs	30	Daily	9.77	96.45	58.68	106.22	164.91	0.94	48.23	49.17
Terraces	30	Daily	7.07	34.83	63.10	41.90	105.00	0.48	17.42	17.90
Reduced Till	30	Daily	6.93	46.72	60.77	53.66	114.43	0.51	23.36	23.87
All BMPs	30	Daily	6.05	13.30	65.17	19.35	84.51	0.36	6.65	7.01
No-Till	30	Daily	11.48	28.01	51.05	39.49	90.54	1.86	14.01	15.86
No BMPs-Plowdown	30	6-Month	9.42	96.45	58.90	105.88	164.77	0.48	48.23	48.71
Terraces-Plowdown	30	6-Month	7.91	34.83	63.48	42.74	106.22	0.42	17.42	17.84
Reduced Till-Plowdown	30	6-Month	7.74	46.72	61.10	54.47	115.57	0.45	23.36	23.81
All BMPs-Plowdown	30	6-Month	6.55	13.30	65.49	19.85	85.35	0.26	6.65	6.91
No-Till-Topdress	30	6-Month	11.08	28.01	46.92	39.09	86.01	1.43	14.01	15.43
No BMPs-Plowdown	30	12-Month	9.61	96.45	46.50	106.06	152.57	0.24	48.23	48.47
Terraces-Plowdown	30	12-Month	8.61	34.83	49.35	43.44	92.79	0.20	17.42	17.62
Reduced Till-Plowdown	30	12-Month	8.38	46.72	50.30	55.10	105.41	0.23	23.36	23.59
All BMPs-Plowdown	30	12-Month	7.77	13.30	51.72	21.07	72.79	0.21	6.65	6.86
No-Till-Topdress	30	12-Month	12.99	28.01	34.15	41.00	75.15	1.35	14.01	15.35
No BMPs-Injection	30	12-Month	13.60	96.45	59.83	110.05	169.88	0.28	48.23	48.51
Terraces-Injection	30	12-Month	11.90	34.83	64.29	46.73	111.02	0.26	17.42	17.68
Reduced Till-Injection	30	12-Month	11.40	46.72	63.32	58.12	121.44	0.26	23.36	23.62
All BMPs-Injection	30	12-Month	10.74	13.30	62.03	24.04	86.07	0.25	6.65	6.90
No-Till-Injection	30	12-Month	15.65	28.01	61.84	43.66	105.50	1.11	14.01	15.12
No BMPs	20	Daily	7.50	72.34	38.82	79.84	118.66	0.77	38.58	39.35
Terraces	20	Daily	5.37	26.12	41.64	31.49	73.13	0.33	13.93	14.26
Reduced Till	20	Daily	5.21	35.04	40.24	40.25	80.49	0.35	18.69	19.03
All BMPs	20	Daily	4.89	9.98	43.26	14.87	58.12	0.31	5.32	5.64
No-Till	20	Daily	9.19	21.01	31.14	30.20	61.34	1.65	11.20	12.85
No BMPs-Plowdown	20	6-Month	7.12	72.34	43.44	79.46	122.90	0.39	38.58	38.97
Terraces-Plowdown	20	6-Month	5.98	26.12	46.75	32.10	78.85	0.34	13.93	14.27
Reduced Till-Plowdown	20	6-Month	5.86	35.04	44.98	40.90	85.88	0.36	18.69	19.05
All BMPs-Plowdown	20	6-Month	5.00	9.98	48.27	14.97	63.24	0.23	5.32	5.55
No-Till-Topdress	20	6-Month	8.52	21.01	34.26	29.52	63.78	1.25	11.20	12.45

Table B16 -- (Continued.)

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs-Plowdown	20	12-Month	7.19	72.34	34.65	79.53	114.18	0.23	38.58	38.81
Terraces-Plowdown	20	12-Month	6.44	26.12	37.31	32.56	69.87	0.19	13.93	14.12
Reduced Till-Plowdown	20	12-Month	6.18	35.04	36.18	41.22	77.40	0.21	18.69	18.90
All BMPs-Plowdown	20	12-Month	5.80	9.98	38.92	15.77	54.70	0.20	5.32	5.52
No-Till-Topdress	20	12-Month	9.06	21.01	19.81	30.07	49.88	1.19	11.20	12.40
No BMPs-Injection	20	12-Month	7.76	72.34	26.69	80.10	106.79	0.26	38.58	38.84
Terraces-Injection	20	12-Month	7.11	26.12	29.43	33.23	62.66	0.24	13.93	14.17
Reduced Till-Injection	20	12-Month	6.70	35.04	28.82	41.74	70.56	0.25	18.69	18.94
All BMPs-Injection	20	12-Month	6.64	9.98	29.83	16.62	46.45	0.24	5.32	5.56
No-Till-Injection	20	12-Month	9.41	21.01	28.15	30.42	58.57	1.04	11.20	12.24
No BMPs	15	Daily	6.25	48.23	32.23	54.48	86.71	0.64	24.11	24.75
Terraces	15	Daily	4.55	17.42	34.54	21.97	56.51	0.30	8.71	9.01
Reduced Till	15	Daily	4.43	23.36	33.35	27.79	61.14	0.33	11.68	12.01
All BMPs	15	Daily	4.14	6.65	35.88	10.79	46.67	0.31	3.33	3.63
No-Till	15	Daily	7.74	14.01	25.58	21.74	47.32	1.39	7.00	8.39
No BMPs-Plowdown	15	6-Month	5.97	48.23	35.71	54.19	89.90	0.35	24.11	24.47
Terraces-Plowdown	15	6-Month	5.02	17.42	38.38	22.43	60.81	0.31	8.71	9.02
Reduced Till-Plowdown	15	6-Month	4.91	23.36	36.91	28.28	65.18	0.35	11.68	12.03
All BMPs-Plowdown	15	6-Month	4.22	6.65	39.65	10.87	50.52	0.25	3.33	3.57
No-Till-Topdress	15	6-Month	7.23	14.01	27.92	21.24	49.16	1.09	7.00	8.09
No BMPs-Plowdown	15	12-Month	6.02	48.23	29.12	54.25	83.37	0.21	24.11	24.33
Terraces-Plowdown	15	12-Month	5.36	17.42	31.31	22.78	54.08	0.18	8.71	8.89
Reduced Till-Plowdown	15	12-Month	5.16	23.36	30.32	28.52	58.84	0.20	11.68	11.88
All BMPs-Plowdown	15	12-Month	4.82	6.65	32.65	11.47	44.12	0.18	3.33	3.51
No-Till-Topdress	15	12-Month	7.64	14.01	17.09	21.65	38.74	1.01	7.00	8.01
No BMPs-Injection	15	12-Month	6.38	48.23	23.15	54.61	77.76	0.23	24.11	24.34
Terraces-Injection	15	12-Month	5.82	17.42	25.40	23.24	48.64	0.21	8.71	8.92
Reduced Till-Injection	15	12-Month	5.50	23.36	24.79	28.86	53.65	0.22	11.68	11.90
All BMPs-Injection	15	12-Month	5.42	6.65	25.73	12.07	37.80	0.21	3.33	3.54
No-Till-Injection	15	12-Month	7.36	14.01	18.74	21.37	40.11	0.89	7.00	7.89
No BMPs	10	Daily	5.76	48.23	28.25	53.99	82.24	0.50	24.11	24.61
Terraces	10	Daily	4.45	17.42	30.30	21.86	52.16	0.26	8.71	8.97
Reduced Till	10	Daily	4.32	23.36	29.27	27.69	56.95	0.30	11.68	11.98
All BMPs	10	Daily	4.04	6.65	31.52	10.69	42.22	0.28	3.33	3.60
No-Till	10	Daily	7.25	14.01	21.64	21.25	42.90	1.22	7.00	8.22
No BMPs-Plowdown	10	6-Month	5.28	48.23	29.24	53.51	82.75	0.31	24.11	24.42
Terraces-Plowdown	10	6-Month	4.49	17.42	31.41	21.90	53.32	0.27	8.71	8.98
Reduced Till-Plowdown	10	6-Month	4.39	23.36	30.23	27.76	57.99	0.31	11.68	11.99
All BMPs-Plowdown	10	6-Month	3.86	6.65	32.53	10.51	43.03	0.24	3.33	3.56
No-Till-Topdress	10	6-Month	6.71	14.01	22.86	20.72	43.58	1.02	7.00	8.03
No BMPs-Plowdown	10	12-Month	4.85	48.23	23.59	53.08	76.66	0.23	24.11	24.34
Terraces-Plowdown	10	12-Month	4.28	17.42	25.29	21.70	46.99	0.20	8.71	8.90
Reduced Till-Plowdown	10	12-Month	4.13	23.36	24.45	27.49	51.95	0.23	11.68	11.91
All BMPs-Plowdown	10	12-Month	3.84	6.65	26.37	10.49	36.86	0.22	3.33	3.54
No-Till-Topdress	10	12-Month	6.38	14.01	14.64	20.39	35.02	1.00	7.00	8.00
No BMPs-Injection	10	12-Month	5.15	48.23	19.06	53.38	72.44	0.24	24.11	24.35
Terraces-Injection	10	12-Month	4.63	17.42	20.39	22.05	42.44	0.22	8.71	8.93
Reduced Till-Injection	10	12-Month	4.41	23.36	19.88	27.77	47.65	0.24	11.68	11.92
All BMPs-Injection	10	12-Month	4.29	6.65	20.74	10.94	31.68	0.23	3.33	3.56
No-Till-Injection	10	12-Month	6.12	14.01	14.51	20.13	34.64	0.92	7.00	7.92

Table B17 --CREAMS Estimates of Nutrient Losses (lbs/acre) for Corn Silage Following Corn Grain on a 9 Percent Slope

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs	40	Daily	14.28	146.44	53.62	160.72	214.34	2.78	76.15	78.93
Terraces	40	Daily	12.54	52.04	57.08	64.58	121.66	2.36	27.06	29.41
Reduced Till	40	Daily	12.38	75.68	54.99	88.07	143.06	2.35	39.36	41.71
All BMPs	40	Daily	12.78	20.94	58.54	33.72	92.26	2.49	10.89	13.38
No-Till	40	Daily	15.72	53.87	49.60	69.59	119.19	3.89	28.01	31.90
No BMPs-Plowdown	40	6-Month	9.57	146.44	66.17	156.01	222.19	0.59	76.15	76.74
Terraces-Plowdown	40	6-Month	8.67	52.04	70.66	60.71	131.36	0.54	27.06	27.60
Reduced Till-Plowdown	40	6-Month	8.60	75.68	67.84	84.28	152.12	0.58	39.36	39.93
All BMPs-Plowdown	40	6-Month	7.57	20.94	72.79	28.50	101.29	0.34	10.89	11.22
No-Till-Topdress	40	6-Month	10.95	53.87	54.22	64.82	119.04	1.67	28.01	29.68
No BMPs-Plowdown	40	12-Month	9.27	146.44	49.55	155.71	205.26	0.27	76.15	76.42
Terraces-Plowdown	40	12-Month	8.59	52.04	53.06	60.62	113.68	0.25	27.06	27.31
Reduced Till-Plowdown	40	12-Month	8.28	75.68	51.72	83.97	135.69	0.27	39.36	39.63
All BMPs-Plowdown	40	12-Month	8.01	20.94	55.70	28.94	84.64	0.26	10.89	11.15
No-Till-Topdress	40	12-Month	12.07	53.87	24.39	65.94	90.33	1.62	28.01	29.63
No BMPs-Injection	40	12-Month	15.47	146.44	62.05	161.91	223.96	0.32	76.15	76.47
Terraces-Injection	40	12-Month	14.18	52.04	66.47	66.22	132.69	0.30	27.06	27.36
Reduced Till-Injection	40	12-Month	13.58	75.68	64.94	89.26	154.20	0.30	39.36	39.66
All BMPs-Injection	40	12-Month	13.14	20.94	63.53	34.08	97.61	0.30	10.89	11.19
No-Till-Injection	40	12-Month	16.39	53.87	63.06	70.26	133.32	1.16	28.01	29.17
No BMPs	30	Daily	8.34	117.16	49.61	125.50	175.11	1.14	58.58	59.71
Terraces	30	Daily	7.22	41.63	52.46	48.85	101.31	0.91	20.81	21.72
Reduced Till	30	Daily	7.21	60.55	50.38	67.76	118.14	0.93	30.27	31.21
All BMPs	30	Daily	7.59	16.75	53.66	24.34	78.00	1.08	8.37	9.45
No-Till	30	Daily	9.35	43.09	45.89	52.44	98.33	2.12	21.55	23.67
No BMPs-Plowdown	30	6-Month	7.32	117.16	50.57	124.48	175.05	0.48	58.58	59.06
Terraces-Plowdown	30	6-Month	6.63	41.63	53.90	48.26	102.16	0.44	20.81	21.26
Reduced Till-Plowdown	30	6-Month	6.59	60.55	51.71	67.14	118.85	0.47	30.27	30.75
All BMPs-Plowdown	30	6-Month	5.80	16.75	55.53	22.55	78.08	0.29	8.37	8.67
No-Till-Topdress	30	6-Month	8.37	43.09	41.72	51.46	93.18	1.50	21.55	23.04
No BMPs-Plowdown	30	12-Month	7.09	117.16	38.06	124.24	162.30	0.24	58.58	58.82
Terraces-Plowdown	30	12-Month	6.56	41.63	40.66	48.19	88.85	0.23	20.81	21.04
Reduced Till-Plowdown	30	12-Month	6.32	60.55	39.32	66.87	106.19	0.25	30.27	30.52
All BMPs-Plowdown	30	12-Month	6.12	16.75	42.66	22.87	65.54	0.24	8.37	8.61
No-Till-Topdress	30	12-Month	9.17	43.09	19.13	52.27	71.40	1.46	21.55	23.01
No BMPs-Injection	30	12-Month	9.54	117.16	28.63	126.70	155.33	0.28	58.58	58.86
Terraces-Injection	30	12-Month	8.85	41.63	30.83	50.48	81.31	0.26	20.81	21.07
Reduced Till-Injection	30	12-Month	8.39	60.55	30.40	68.94	99.34	0.26	30.27	30.53
All BMPs-Injection	30	12-Month	8.31	16.75	29.67	25.06	54.73	0.26	8.37	8.63
No-Till-Injection	30	12-Month	10.31	43.09	29.81	53.40	83.21	1.12	21.55	22.67
No BMPs	20	Daily	6.91	87.87	34.36	94.78	129.14	0.96	46.86	47.82
Terraces	20	Daily	5.99	31.22	36.17	37.21	73.38	0.75	16.65	17.40
Reduced Till	20	Daily	5.90	45.41	34.87	51.32	86.18	0.77	24.22	24.98
All BMPs	20	Daily	6.70	12.56	37.26	19.26	56.52	1.03	6.70	7.72
No-Till	20	Daily	8.44	32.32	27.71	40.76	68.46	1.91	17.24	19.15
No BMPs-Plowdown	20	6-Month	5.41	87.87	36.63	93.28	129.91	0.39	46.86	47.25
Terraces-Plowdown	20	6-Month	4.91	31.22	38.94	36.13	75.07	0.36	16.65	17.01
Reduced Till-Plowdown	20	6-Month	4.88	45.41	37.32	50.30	87.61	0.38	24.22	24.60
All BMPs-Plowdown	20	6-Month	4.33	12.56	40.16	16.89	57.05	0.26	6.70	6.96
No-Till-Topdress	20	6-Month	6.77	32.32	30.42	39.09	69.51	1.30	17.24	18.54

Table B17 — (Continued.)

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs-Plowdown	20	12-Month	4.84	87.87	26.08	92.70	118.79	0.23	46.86	47.09
Terraces-Plowdown	20	12-Month	4.47	31.22	27.73	35.69	63.42	0.21	16.65	16.86
Reduced Till-Plowdown	20	12-Month	4.33	45.41	26.74	49.74	76.49	0.23	24.22	24.45
All BMPs-Plowdown	20	12-Month	4.18	12.56	29.08	16.74	45.83	0.22	6.70	6.92
No-Till-Topdress	20	12-Month	6.24	32.32	13.62	38.56	52.18	1.27	17.24	18.51
No BMPs-Injection	20	12-Month	5.92	87.87	16.28	93.79	110.07	0.26	46.86	47.12
Terraces-Injection	20	12-Month	5.56	31.22	18.02	36.78	54.80	0.25	16.65	16.90
Reduced Till-Injection	20	12-Month	5.27	45.41	17.65	50.68	68.33	0.26	24.22	24.48
All BMPs-Injection	20	12-Month	5.33	12.56	18.32	17.89	36.21	0.25	6.70	6.95
No-Till-Injection	20	12-Month	6.26	32.32	15.78	38.58	54.36	1.05	17.24	18.29
No BMPs	15	Daily	6.28	58.58	30.48	64.86	95.34	0.78	29.29	30.07
Terraces	15	Daily	5.50	20.81	32.15	26.32	58.47	0.62	10.41	11.02
Reduced Till	15	Daily	5.42	30.27	30.99	35.70	66.69	0.65	15.14	15.79
All BMPs	15	Daily	5.99	8.37	33.23	14.36	47.59	0.85	4.19	5.03
No-Till	15	Daily	7.81	21.55	23.73	29.36	53.09	1.59	10.77	12.36
No BMPs-Plowdown	15	6-Month	5.16	58.58	32.18	63.74	95.92	0.36	29.29	29.64
Terraces-Plowdown	15	6-Month	4.69	20.81	34.23	25.51	59.73	0.33	10.41	10.73
Reduced Till-Plowdown	15	6-Month	4.66	30.27	32.83	34.93	67.76	0.37	15.14	15.50
All BMPs-Plowdown	15	6-Month	4.21	8.37	35.40	12.58	47.98	0.27	4.19	4.46
No-Till-Topdress	15	6-Month	6.57	21.55	25.76	28.11	53.88	1.13	10.77	11.91
No BMPs-Plowdown	15	12-Month	4.13	58.58	22.30	62.71	85.01	0.22	29.29	29.50
Terraces-Plowdown	15	12-Month	3.81	20.81	23.65	24.63	48.27	0.20	10.41	10.61
Reduced Till-Plowdown	15	12-Month	3.71	30.27	22.77	33.99	56.75	0.22	15.14	15.36
All BMPs-Plowdown	15	12-Month	3.57	8.37	24.80	11.95	36.74	0.21	4.19	4.40
No-Till-Topdress	15	12-Month	6.05	21.55	12.94	27.60	40.55	1.07	10.77	11.84
No BMPs-Injection	15	12-Month	4.54	58.58	12.76	63.12	75.88	0.23	29.29	29.52
Terraces-Injection	15	12-Month	4.26	20.81	13.99	25.07	39.06	0.22	10.41	10.63
Reduced Till-Injection	15	12-Month	4.05	30.27	13.64	34.32	47.96	0.22	15.14	15.36
All BMPs-Injection	15	12-Month	4.08	8.37	14.22	12.45	26.67	0.22	4.19	4.41
No-Till-Injection	15	12-Month	4.80	21.55	12.49	26.35	38.84	1.90	10.77	11.67
No BMPs	10	Daily	5.58	58.58	27.33	64.15	91.49	0.60	29.29	29.88
Terraces	10	Daily	4.95	20.81	28.88	25.77	54.64	0.48	10.41	10.89
Reduced Till	10	Daily	4.87	30.27	27.83	35.14	62.97	0.52	15.14	15.65
All BMPs	10	Daily	5.19	8.37	29.97	13.57	43.53	0.64	4.19	4.83
No-Till	10	Daily	7.24	21.55	19.78	28.78	48.56	1.36	10.77	12.13
No BMPs-Plowdown	10	6-Month	4.83	58.58	28.48	63.41	91.89	0.31	29.29	29.60
Terraces-Plowdown	10	6-Month	4.42	20.81	30.27	25.23	55.51	0.29	10.41	10.70
Reduced Till-Plowdown	10	6-Month	4.36	30.27	29.07	34.63	63.70	0.33	15.14	15.46
All BMPs-Plowdown	10	6-Month	4.01	8.37	31.43	12.38	43.82	0.26	4.19	4.45
No-Till-Topdress	10	6-Month	6.41	21.55	21.14	27.96	49.09	1.06	10.77	11.83
No BMPs-Plowdown	10	12-Month	4.19	58.58	21.39	62.77	84.17	0.23	29.29	29.52
Terraces-Plowdown	10	12-Month	3.87	20.81	22.71	24.69	47.40	0.22	10.41	10.62
Reduced Till-Plowdown	10	12-Month	3.77	30.27	21.88	34.05	55.93	0.25	15.14	15.39
All BMPs-Plowdown	10	12-Month	3.63	8.37	23.83	12.01	35.84	0.24	4.19	4.43
No-Till-Topdress	10	12-Month	6.03	21.55	12.58	27.58	40.16	1.05	10.77	11.82
No BMPs-Injection	10	12-Month	4.41	58.58	14.64	62.99	77.63	0.24	29.29	29.53
Terraces-Injection	10	12-Month	4.11	20.81	15.55	24.92	40.47	0.23	10.41	10.64
Reduced Till-Injection	10	12-Month	3.95	30.27	15.15	34.22	49.37	0.24	15.14	15.38
All BMPs-Injection	10	12-Month	3.93	8.37	15.91	12.30	28.21	0.23	4.19	4.42
No-Till-Injection	10	12-Month	5.08	21.55	11.29	26.63	38.92	0.93	10.77	11.70

Table B18 -- CREAMS Estimates of Nutrient Losses (lbs/acre) for Corn Silage Following Corn Silage on a 9 Percent Slope

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs	40	Daily	14.28	166.26	53.62	180.53	234.15	2.78	86.45	89.23
Terraces	40	Daily	12.54	59.34	57.08	71.88	128.97	2.36	30.86	33.21
Reduced Till	40	Daily	12.38	105.78	54.99	118.16	173.16	2.35	55.00	57.36
All BMPs	40	Daily	9.47	28.67	58.54	38.14	96.68	1.78	14.91	16.69
No-Till	40	Daily	14.93	72.40	49.03	87.33	136.36	3.63	37.65	41.27
No BMPs-Plowdown	40	6-Month	9.57	166.26	66.17	175.82	242.00	0.59	86.45	87.05
Terraces-Plowdown	40	6-Month	8.67	59.34	70.66	68.01	138.67	0.54	30.86	31.40
Reduced Till-Plowdown	40	6-Month	8.60	105.78	67.84	114.37	182.22	0.58	55.00	55.58
All BMPs-Plowdown	40	6-Month	6.27	28.67	72.79	34.94	107.72	0.30	14.91	15.21
No-Till-Topdress	40	6-Month	10.63	72.40	53.37	83.03	136.40	1.58	37.65	39.23
No BMPs-Plowdown	40	12-Month	9.27	166.26	49.55	175.53	225.08	0.27	86.45	86.73
Terraces-Plowdown	40	12-Month	8.59	59.34	53.06	67.93	120.98	0.25	30.86	31.11
Reduced Till-Plowdown	40	12-Month	8.28	105.78	51.72	114.06	165.79	0.27	55.00	55.28
All BMPs-Plowdown	40	12-Month	7.85	28.67	55.70	36.52	92.21	0.23	14.91	15.14
No-Till-Topdress	40	12-Month	12.47	72.40	30.30	84.87	115.18	1.48	37.65	39.13
No BMPs-Injection	40	12-Month	15.47	166.26	62.05	181.73	243.78	0.32	86.45	86.77
Terraces-Injection	40	12-Month	14.18	59.34	66.47	73.52	139.99	0.30	30.86	31.16
Reduced Till-Injection	40	12-Month	13.58	105.78	64.94	119.36	184.30	0.30	55.00	55.30
All BMPs-Injection	40	12-Month	12.38	28.67	63.53	41.05	104.58	0.28	14.91	15.19
No-Till-Injection	40	12-Month	16.85	72.40	67.45	89.25	156.70	1.15	37.65	38.80
No BMPs	30	Daily	8.34	133.01	49.61	141.35	190.96	1.14	66.50	67.64
Terraces	30	Daily	7.22	47.47	52.46	54.69	107.15	0.91	23.74	24.64
Reduced Till	30	Daily	7.21	84.62	50.38	91.83	142.21	0.93	42.31	43.24
All BMPs	30	Daily	4.29	22.93	53.66	27.23	80.88	0.36	11.47	11.83
No-Till	30	Daily	8.56	57.92	45.34	66.48	111.82	1.86	28.96	30.82
No BMPs-Plowdown	30	6-Month	7.32	133.01	50.57	140.33	190.90	0.48	66.50	66.99
Terraces-Plowdown	30	6-Month	6.63	47.47	53.90	54.10	108.01	0.44	23.74	24.18
Reduced Till-Plowdown	30	6-Month	6.59	84.62	51.71	91.21	142.92	0.47	42.31	42.78
All BMPs-Plowdown	30	6-Month	4.78	22.93	55.53	27.71	83.24	0.26	11.47	11.73
No-Till-Topdress	30	6-Month	8.16	57.92	41.09	66.08	107.17	1.43	28.96	30.39
No BMPs-Plowdown	30	12-Month	7.09	133.01	38.06	140.09	178.15	0.24	66.50	66.75
Terraces-Plowdown	30	12-Month	6.56	47.47	40.66	54.03	94.69	0.23	23.74	23.96
Reduced Till-Plowdown	30	12-Month	6.32	84.62	39.32	90.95	130.27	0.25	42.31	42.56
All BMPs-Plowdown	30	12-Month	5.94	22.93	42.66	28.87	71.54	0.21	11.47	11.68
No-Till-Topdress	30	12-Month	8.98	57.92	19.17	66.90	86.07	1.35	28.96	30.31
No BMPs-Injection	30	12-Month	9.54	133.01	28.63	142.55	171.18	0.28	66.50	66.78
Terraces-Injection	30	12-Month	8.85	47.47	30.83	56.32	87.15	0.26	23.74	24.00
Reduced Till-Injection	30	12-Month	8.39	84.62	30.40	93.01	123.41	0.26	42.31	42.57
All BMPs-Injection	30	12-Month	8.19	22.93	29.67	31.12	60.79	0.24	11.47	11.71
No-Till-Injection	30	12-Month	10.89	57.92	34.72	68.81	103.53	1.10	28.96	30.06
No BMPs	20	Daily	6.91	99.75	34.36	106.67	141.02	0.96	53.20	54.16
Terraces	20	Daily	5.99	35.60	36.17	41.59	77.77	0.75	18.99	19.74
Reduced Till	20	Daily	5.90	63.47	34.87	69.37	104.24	0.77	33.85	34.61
All BMPs	20	Daily	3.98	17.20	37.26	21.18	58.44	0.31	9.17	9.49
No-Till	20	Daily	7.71	43.44	27.63	51.15	78.78	1.65	23.17	24.81
No BMPs-Plowdown	20	6-Month	5.41	99.75	36.63	105.17	141.80	0.39	53.20	53.59
Terraces-Plowdown	20	6-Month	4.91	35.60	38.94	40.51	79.45	0.36	18.99	19.35
Reduced Till-Plowdown	20	6-Month	4.88	63.47	37.32	68.35	105.67	0.38	33.85	34.23
All BMPs-Plowdown	20	6-Month	3.59	17.20	40.16	20.79	60.95	0.23	9.17	9.41
No-Till-Topdress	20	6-Month	6.63	43.44	30.04	50.07	80.11	1.25	23.17	24.41

Table B18.--(Continued.)

Best Management Practices	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs-Plowdown	20	12-Month	4.84	99.75	26.08	104.59	130.68	0.23	53.20	53.43
Terraces-Plowdown	20	12-Month	4.47	35.60	27.73	40.07	67.80	0.21	18.99	19.20
Reduced Till-Plowdown	20	12-Month	4.33	63.47	26.74	67.80	94.54	0.23	33.85	34.08
All BMPs-Plowdown	20	12-Month	4.00	17.20	29.08	21.20	50.29	0.20	9.17	9.37
No-Till-Topdress	20	12-Month	6.15	43.44	13.69	49.59	63.28	1.19	23.17	24.36
No BMPs-Injection	20	12-Month	5.92	99.75	16.28	105.67	121.85	0.26	53.20	53.46
Terraces-Injection	20	12-Month	5.56	35.60	18.02	41.16	59.18	0.25	18.99	19.24
Reduced Till-Injection	20	12-Month	5.27	63.47	17.65	68.74	86.39	0.26	33.85	34.11
All BMPs-Injection	20	12-Month	5.13	17.20	18.32	22.33	40.65	0.24	9.17	9.41
No-Till-Injection	20	12-Month	6.01	43.44	15.78	49.45	65.23	1.04	23.17	24.21
No BMPs	15	Daily	6.28	66.50	30.48	72.78	103.26	0.78	33.25	34.04
Terraces	15	Daily	5.50	23.74	32.15	29.24	61.39	0.62	11.87	12.49
Reduced Till	15	Daily	5.42	42.31	30.99	47.73	78.73	0.65	21.16	21.81
All BMPs	15	Daily	3.90	11.47	33.23	15.37	48.59	0.31	5.73	6.04
No-Till	15	Daily	7.26	28.96	23.71	36.22	59.93	1.39	14.48	15.87
No BMPs-Plowdown	15	6-Month	5.16	66.50	32.18	71.66	103.84	0.36	33.25	33.61
Terraces-Plowdown	15	6-Month	4.69	23.74	34.23	28.43	62.66	0.33	11.87	12.19
Reduced Till-Plowdown	15	6-Month	4.66	42.31	32.83	46.97	79.80	0.37	21.16	21.52
All BMPs-Plowdown	15	6-Month	3.61	11.47	35.40	15.08	50.48	0.25	5.73	5.98
No-Till-Topdress	15	6-Month	6.45	28.96	25.51	35.41	60.93	1.09	14.48	15.57
No BMPs-Plowdown	15	12-Month	4.13	66.50	22.30	70.64	92.94	0.22	33.25	33.47
Terraces-Plowdown	15	12-Month	3.81	23.74	23.65	27.55	51.19	0.20	11.87	12.07
Reduced Till-Plowdown	15	12-Month	3.71	42.31	22.77	46.02	68.79	0.22	21.16	21.37
All BMPs-Plowdown	15	12-Month	3.40	11.47	24.80	14.86	39.66	0.18	5.73	5.92
No-Till-Topdress	15	12-Month	5.97	28.96	13.03	34.93	47.96	1.01	14.48	15.49
No BMPs-Injection	15	12-Month	4.54	66.50	12.76	71.04	83.80	0.23	33.25	33.48
Terraces-Injection	15	12-Month	4.26	23.74	13.99	28.00	41.99	0.22	11.87	12.09
Reduced Till-Injection	15	12-Month	4.05	42.31	13.64	46.36	56.00	0.22	21.16	21.38
All BMPs-Injection	15	12-Month	3.90	11.47	14.22	15.37	29.59	0.21	5.73	5.94
No-Till-Injection	15	12-Month	4.90	28.96	12.55	33.86	46.41	0.89	14.48	15.37
No BMPs	10	Daily	5.58	66.50	27.33	72.08	99.41	0.60	33.25	33.85
Terraces	10	Daily	4.95	23.74	28.88	28.69	57.56	0.48	11.87	12.35
Reduced Till	10	Daily	4.87	42.31	27.83	47.18	75.01	0.52	21.16	21.67
All BMPs	10	Daily	3.76	11.47	29.97	15.22	45.19	0.28	5.73	6.01
No-Till	10	Daily	6.84	28.96	19.80	35.80	55.61	1.22	14.48	15.70
No BMPs-Plowdown	10	6-Month	4.83	66.50	28.48	71.34	99.82	0.31	33.25	33.57
Terraces-Plowdown	10	6-Month	4.42	23.74	30.27	28.15	58.43	0.29	11.87	12.16
Reduced Till-Plowdown	10	6-Month	4.36	42.31	29.07	46.67	75.74	0.33	21.16	21.48
All BMPs-Plowdown	10	6-Month	3.57	11.47	31.43	15.03	46.47	0.24	5.73	5.97
No-Till-Topdress	10	6-Month	6.31	28.96	21.01	35.27	56.28	1.02	14.48	15.50
No BMPs-Plowdown	10	12-Month	4.19	66.50	21.39	70.70	92.09	0.23	33.25	33.49
Terraces-Plowdown	10	12-Month	3.87	23.74	22.71	27.61	50.32	0.22	11.87	12.08
Reduced Till-Plowdown	10	12-Month	3.77	42.31	21.88	46.09	67.96	0.25	21.16	21.41
All BMPs-Plowdown	10	12-Month	3.47	11.47	23.83	14.93	38.77	0.22	5.73	5.95
No-Till-Topdress	10	12-Month	5.96	28.96	12.68	34.92	47.60	1.00	14.48	15.48
No BMPs-Injection	10	12-Month	4.41	66.50	14.64	70.91	85.55	0.24	33.25	33.49
Terraces-Injection	10	12-Month	4.11	23.74	15.55	27.85	43.40	0.23	11.87	12.10
Reduced Till-Injection	10	12-Month	3.95	42.31	15.15	46.26	61.41	0.24	21.16	21.40
All BMPs-Injection	10	12-Month	3.76	11.47	15.91	15.23	31.14	0.22	5.73	5.95
No-Till-Injection	10	12-Month	5.13	28.96	11.35	34.09	45.44	0.92	14.48	15.40

Table B19--CREAMS Estimates of Nutrient Losses (lbs/acre) for Direct Seeded Alfalfa

Best Management Practices	Slope	Manure (T/A)	Storage Period	Nitrogen Losses					Phosphorus Losses		
				Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs	2	20	Daily	1.09	1.73	24.08	2.82	26.90	0.19	0.92	1.11
Reduced Till	2	20	Daily	1.06	1.16	24.03	2.22	26.24	0.19	0.62	0.80
All BMPs	2	20	Daily	0.98	0.83	22.93	1.80	24.73	0.19	0.44	0.63
No-Till	2	20	Daily	1.60	1.08	22.68	2.67	25.35	0.77	0.57	1.34
No BMPs	2	20	6- or 12-Mo.	1.83	1.73	39.54	3.55	43.09	0.19	0.92	1.11
Reduced Till	2	20	6- or 12-Mo.	1.75	1.16	39.76	2.91	42.67	0.19	0.62	0.80
All BMPs	2	20	6- or 12-Mo.	1.60	0.83	38.36	2.43	40.79	0.19	0.44	0.63
No-Till	2	20	6- or 12-Mo.	2.09	1.08	29.82	3.16	32.98	0.77	0.57	1.34
No BMPs	2	10	Daily	0.65	1.73	10.14	2.38	12.53	0.14	0.92	1.06
Reduced Till	2	10	Daily	0.63	1.16	10.07	1.79	11.87	0.14	0.62	0.76
All BMPs	2	10	Daily	0.63	0.83	10.21	1.46	11.67	0.14	0.44	0.58
No-Till	2	10	Daily	0.72	1.08	8.30	1.80	10.10	0.64	0.57	1.21
No BMPs	2	10	6- or 12-Mo.	0.69	1.73	13.42	2.42	15.84	0.14	0.92	1.06
Reduced Till	2	10	6- or 12-Mo.	0.67	1.16	13.31	1.83	15.14	0.14	0.62	0.76
All BMPs	2	10	6- or 12-Mo.	0.66	0.83	12.87	1.48	14.35	0.14	0.44	0.58
No-Till	2	10	6- or 12-Mo.	0.75	1.08	9.75	1.83	11.58	0.64	0.57	1.21
No BMPs	2	0	None	0.64	1.73	6.63	2.37	9.00	0.14	0.92	1.06
Reduced Till	2	0	None	0.62	1.16	6.70	1.78	8.48	0.14	0.62	0.76
All BMPs	2	0	None	0.62	0.83	6.72	1.44	8.16	0.14	0.44	0.58
No-Till	2	0	None	0.66	1.08	6.53	1.74	8.26	0.64	0.57	1.22
No BMPs	5	20	Daily	1.09	5.84	24.08	6.93	31.01	0.19	3.11	3.31
Terraces	5	20	Daily	0.96	2.22	24.89	3.18	28.08	0.18	1.19	1.36
Reduced Till	5	20	Daily	1.06	4.25	24.02	5.30	29.32	0.19	2.26	2.45
All BMPs	5	20	Daily	0.90	1.41	23.65	2.31	25.95	0.18	0.75	0.93
No-Till	5	20	Daily	1.61	3.40	22.61	5.01	27.62	0.78	1.81	2.60
No BMPs	5	20	6- or 12-Mo.	1.83	5.84	39.54	7.67	47.20	0.19	3.11	3.31
Terraces	5	20	6- or 12-Mo.	1.56	2.22	41.66	3.79	45.44	0.18	1.19	1.36
Reduced Till	5	20	6- or 12-Mo.	1.75	4.25	39.74	6.00	45.74	0.19	2.26	2.45
All BMPs	5	20	6- or 12-Mo.	1.44	1.41	39.96	2.85	42.82	0.18	0.75	0.93
No-Till	5	20	6- or 12-Mo.	2.10	3.40	29.75	5.50	35.24	0.78	1.81	2.60
No BMPs	5	10	Daily	0.65	5.84	10.14	6.49	16.64	0.14	3.11	3.26
Terraces	5	10	Daily	0.60	2.22	10.70	2.82	13.52	0.13	1.19	1.32
Reduced Till	5	10	Daily	0.63	4.25	10.07	4.88	14.95	0.14	2.26	2.40
All BMPs	5	10	Daily	0.59	1.41	10.70	2.00	12.70	0.13	0.75	0.88
No-Till	5	10	Daily	0.73	3.40	8.27	4.13	12.40	0.65	1.81	2.46
No BMPs	5	10	6- or 12-Mo.	0.69	5.84	13.42	6.53	19.95	0.14	3.11	3.26
Terraces	5	10	6- or 12-Mo.	0.64	2.22	13.95	2.86	16.81	0.13	1.19	1.32
Reduced Till	5	10	6- or 12-Mo.	0.67	4.25	13.30	4.92	18.22	0.14	2.26	2.40
All BMPs	5	10	6- or 12-Mo.	0.59	1.41	10.70	2.00	12.70	0.13	0.75	0.88
No-Till	5	10	6- or 12-Mo.	0.76	3.40	9.71	4.16	13.88	0.65	1.81	2.46
No BMPs	5	0	None	0.64	5.84	6.63	6.48	13.11	0.14	3.11	3.26
Terraces	5	0	None	0.59	2.22	7.05	2.81	9.86	0.13	1.19	1.32
Reduced Till	5	0	None	0.62	4.25	6.70	4.87	11.56	0.14	2.26	2.40
All BMPs	5	0	None	0.58	1.41	7.08	1.99	9.07	0.13	0.75	0.88
No-Till	5	0	None	0.67	3.40	6.53	4.07	10.60	0.66	1.81	2.47
No BMPs	9	20	Daily	1.09	14.62	24.04	15.71	39.75	0.19	7.80	7.99
Terraces	9	20	Daily	0.96	5.14	24.89	6.10	31.00	0.18	2.74	2.92
Reduced Till	9	20	Daily	1.06	10.78	24.01	11.84	35.84	0.19	5.75	5.94
All BMPs	9	20	Daily	0.90	3.33	23.65	4.22	27.87	0.18	1.77	1.95
No-Till	9	20	Daily	1.61	9.34	22.61	10.95	33.56	0.78	4.98	5.77
No BMPs	9	20	6- or 12-Mo.	1.82	14.62	39.49	16.45	55.93	0.19	7.80	7.99
Terraces	9	20	6- or 12-Mo.	1.56	5.14	41.66	6.71	48.36	0.18	2.74	2.92
Reduced Till	9	20	6- or 12-Mo.	1.75	10.78	39.73	12.53	52.26	0.19	5.75	5.94
All BMPs	9	20	6- or 12-Mo.	1.44	3.33	39.96	4.77	44.73	0.18	1.77	1.95
No-Till	9	20	6- or 12-Mo.	2.10	9.34	29.75	11.44	41.19	0.78	4.98	5.77
No BMPs	9	10	Daily	0.65	14.62	10.14	15.28	25.42	0.14	7.80	7.94
Terraces	9	10	Daily	0.60	5.14	10.70	5.74	16.44	0.13	2.74	2.87
Reduced Till	9	10	Daily	0.63	10.78	10.07	11.41	21.48	0.14	5.75	5.89
All BMPs	9	10	Daily	0.59	3.33	10.70	3.92	14.61	0.13	1.77	1.91
No-Till	9	10	Daily	0.73	9.34	8.27	10.07	18.34	0.65	4.98	5.63
No BMPs	9	10	6- or 12-Mo.	0.69	14.62	13.39	15.32	28.71	0.14	7.80	7.94
Terraces	9	10	6- or 12-Mo.	0.64	5.14	13.95	5.78	19.73	0.13	2.74	2.87
Reduced Till	9	10	6- or 12-Mo.	0.67	10.78	13.30	11.45	24.75	0.14	5.75	5.89
All BMPs	9	10	6- or 12-Mo.	0.62	3.33	13.32	3.94	17.26	0.13	1.77	1.91
No-Till	9	10	6- or 12-Mo.	0.76	9.34	9.71	10.11	19.82	0.65	4.98	5.63
No BMPs	9	0	None	0.64	14.62	6.63	15.26	21.89	0.14	7.80	7.94
Terraces	9	0	None	0.59	5.14	7.05	5.73	12.78	0.13	2.74	2.87
Reduced Till	9	0	None	0.62	10.78	6.70	11.40	18.10	0.14	5.75	5.89
All BMPs	9	0	None	0.58	3.33	7.08	3.90	10.98	0.13	1.77	1.91
No-Till	9	0	None	0.67	9.34	6.53	10.01	16.54	0.66	4.98	5.64

Table B20--CREAMS Estimates of Nutrient Losses (lbs/acre) for Established Alfalfa Meadow

Best Management Practices	Slope	Manure (T/A)	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
No BMPs	2	10	1.28	0.95	19.36	2.23	21.59	0.14	0.50	0.65
All BMPs	2	10	1.31	0.41	18.82	1.72	20.53	0.14	0.22	0.36
No BMPs	5	10	1.30	3.48	19.36	4.78	24.15	0.14	1.86	2.00
Terraces	5	10	1.11	1.28	19.80	2.39	22.19	0.13	0.68	0.81
All BMPs	5	10	1.13	0.79	19.43	1.92	21.34	0.13	0.42	0.55
No BMPs	9	10	1.30	7.13	19.36	8.43	27.79	0.14	3.80	3.95
Terraces	9	10	1.11	2.55	19.80	3.66	23.46	0.13	1.36	1.49
All BMPs	9	10	1.13	2.01	19.43	3.14	22.56	0.13	1.07	1.20
No BMPs	2	5	1.17	0.95	13.33	2.12	15.45	0.22	0.50	0.73
All BMPs	2	5	1.21	0.41	13.01	1.61	14.63	0.24	0.22	0.45
No BMPs	5	5	1.19	3.48	13.33	4.67	18.00	0.23	1.86	2.09
Terraces	5	5	1.00	1.28	13.67	2.29	15.96	0.20	0.68	0.88
All BMPs	5	5	1.02	0.79	13.46	1.81	15.27	0.20	0.42	0.62
No BMPs	9	5	1.19	7.13	13.33	8.32	21.65	0.23	3.80	4.03
Terraces	9	5	1.00	2.55	13.67	3.55	17.22	0.20	1.36	1.56
All BMPs	9	5	1.02	2.01	13.46	3.03	16.49	0.20	1.07	1.27
No BMPs	2	0	1.05	0.95	6.72	2.00	8.71	0.28	0.50	0.78
All BMPs	2	0	1.09	0.41	6.63	1.50	8.13	0.30	0.22	0.52
No BMPs	5	0	1.07	3.48	6.72	4.55	11.27	0.29	1.86	2.15
Terraces	5	0	0.89	1.28	6.94	2.17	9.11	0.24	0.68	0.92
All BMPs	5	0	0.91	0.79	6.89	1.70	8.59	0.25	0.42	0.67
No BMPs	9	0	1.07	7.13	6.72	8.20	14.92	0.29	3.80	4.09
Terraces	9	0	0.89	2.55	6.94	3.43	10.38	0.24	1.36	1.60
All BMPs	9	0	0.91	2.01	6.89	2.92	9.81	0.25	1.07	1.32

Table B21--CREAMS Estimates of Nutrient Losses (lbs/acre) for Permanent Pasture

Timing of Manure Applications	Slope	Manure (T/A)	Nitrogen Losses					Phosphorus Losses		
			Runoff	Sediment	Percolate	Surface	Total	Runoff	Sediment	Total
Spring and Fall	2	20	3.19	0.99	40.97	4.18	45.14	0.36	0.49	0.86
Spring	2	20	3.61	0.99	40.51	4.60	45.11	0.12	0.49	0.62
Fall	2	20	2.54	0.99	61.14	3.53	64.67	0.68	0.49	1.17
Spring	2	10	1.80	0.49	16.02	2.29	18.31	0.11	0.25	0.35
Fall	2	10	1.56	0.49	34.82	2.05	36.88	0.41	0.25	0.66
Fertilized*	2	0	1.28	0.49	12.53	1.78	14 31	0.11	0.25	0.35
Unfertilized	2	0	1.36	0.49	5.40	1.85	7.25	0.41	0.25	0.66
Spring and Fall	5	20	3.19	3.05	40.97	6.24	47.21	0.36	1.53	1.89
Spring	5	20	3.61	3.05	40.51	6.66	47.17	0.12	1.53	1.65
Fall	5	20	2.54	3.05	61.14	5.60	66.73	0.68	1.53	2.20
Spring	5	10	1.80	1.53	16.02	3.33	19.35	0.11	0.76	0.87
Fall	5	10	1.56	1.53	34.82	3.08	37.91	0.41	0.76	1.17
Fertilized*	5	0	1.28	1.53	12.53	2.81	15.34	0.11	0.76	0.87
Unfertilized	5	0	1.36	1.53	5.40	2.88	8.28	0.41	0.76	1.18
Spring and Fall	9	20	3.22	6.67	40.96	9.89	50.85	0.36	3.34	3.70
Spring	9	20	3.67	6.67	40.48	10.34	50.82	0.12	3.34	3.46
Fall	9	20	2.55	6.67	61.14	9.22	70.36	0.68	3.34	4.01
Spring	9	10	1.83	3.34	16.02	5.16	21.18	0.11	1.67	1.77
Fall	9	10	1.56	3.34	34.82	4.89	39.72	0.41	1.67	2.08
Fertilized*	9	0	1.30	3.34	12.53	4.64	17.16	0.11	1.67	1.77
Unfertilized	9	0	1.36	3.34	5.40	4.70	10.10	0.41	1.67	2.08
Spring and Fall	1.5**	20	3.27	0.59	37.02	3.86	40.89	0.37	0.30	0.67
Spring	1.5	20	4.09	0.59	34.36	4.68	39.04	0.13	0.30	0.42
Fall	1.5	20	6.18	0.59	60.59	6.78	67.36	1.85	0.30	2.15
Spring	1.5	10	1.87	0.30	13.18	2.17	15.35	0.11	0.15	0.26
Fall	1.5	10	3.56	0.30	35.76	3.86	39.62	1.05	0.15	1.20
Fertilized*	1.5	0	1.27	0.30	10.40	1.57	11.97	0.11	0.15	0.26
Unfertilized	1.5	0	1.27	0.30	5.97	1.57	7.54	0.38	0.15	0.53

* 500 pounds of 10-10-10 fertilizer.

** Adjacent to stream, Lindside silt loam soil.

* U.S. GOVERNMENT PRINTING OFFICE: 1985-460-938:20051-ERS