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COMPOST AND FERTILIZER EFFECTS ON NITROGEN
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DURING TRANSITION

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COMPOST AND FERTILIZER EFFECTS ON NITROGEN MOVEMENT WITHIN A CROPPING SYSTEM DURING TRANSITION

By

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ABSTRACT

COMPOST AND FERTILIZER EFFECTS ON NITROGEN MOVEMENT WITHIN A CROPPING SYSTEM DURING TRANSITION

by

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Michigan farmers who are concerned about the impacts of conventional farming practices on the environment may be receptive to compost as an alternative to commercial fertilizer. The goal of this study was to compare compost and commercial fertilizer as nutrient sources, specifically for nitrogen (N), in a standard four year Michigan crop rotation consisting of corn (*Zea Mays* L.) followed by corn followed by soybean [*Glycine max* (L.) Merr.] followed by wheat (*Triticum aestivum* L.). Soil, lysimeter leachate, and above-ground plant tissue were tested to determine which nutrient source has less N leaching into the groundwater and adequate available N for the plants. Cover crops, also a component of this study, can provide N (if leguminous) or can decrease N leaching losses by storing excess N. In the initial two years of compost use, compost treated plots had less available soil NO_3-N and less NO_3-N leaching losses compared to fertilized plots. Yield and above-ground biomass N were similar in both compost treated and fertilized soybean and wheat, but lower in compost treated corn. Plots with cover crops compared to plots without cover crops had similar or less available soil NO_3-N and similar yields and biomass N. Compost maintained adequate yields in wheat and soybean, but did not maintain acceptable yields in corn followed by corn.

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LITERATURE REVIEW AND INTRODUCTION

Composting is one of the many pathways for breakdown of organic matter. There are traditions, both mystical and practical, about the composting process. Golueke (1972) simply says that "composting is the biological decomposition of the organic constituents of wastes under controlled conditions." Many materials can be composted, but it is not necessarily known what the end product will contain. Interest in how compost may contribute to preserving environmental quality has increased compost research and has influenced this research.

Mineral fertilizer benefits and weaknesses have been well documented. The use of compost on the farm has not received nearly as much attention. Much of the literature pertaining to composting is currently found in popular literature, with a small but growing amount found in scientific journals. Composting is not necessarily the answer for every situation and may not be of use to some farmers, while it may work very well for others.

Five general guidelines for the composting process have been gleaned from many sources and summarized (Anonymous, 1991a; Golueke and Diaz, 1989). First, the carbon to nitrogen (C:N) ratio of the combined starting materials should be between 20:1 and 30:1. A high ratio will slow or stop composting and a low ratio will result in leaching and volatilization of N. Straw or other plant material are good C sources and manure or urban wastes such as sewage sludge and vegetable matter are good N sources. Second, the moisture content should be between 40% and 60%. A lower or higher moisture content will slow microbiological activity and the composting process. If the moisture is

too low, the composting process may not readily occur due to moisture stress on decomposing microorganisms. High moisture can cause insufficient aeration which will hinder composting and encourage anaerobic decomposition and odors. Third, microorganisms need oxygen (O_2) to break down organic materials. Proper aeration can be maintained by having the correct moisture content, by having the right amount of bulking material (C source), and either by turning windrows to expose more material to O_2 or by forcing air through the composting material by some other means. Fourth, monitoring the temperature of the compost indicates how the composting process is proceeding. A compost windrow temperature of 140 °F (60 °C) is needed to kill weed seeds and pathogens. The windrow is "working" properly if the temperature remains between 130-140 °F (55-60 °C). If the temperature drops below 100 °F, the windrow has either finished composting (microbial activity has ceased) or needs to be turned to provide the microorganisms with additional O_2. Proper temperatures can be maintained in a windrow if the height and width of the pile are about 4 feet each, which is the optimum surface-to-volume ratio. Fifth, innoculums, which are small amounts of microbes or enzymes thought to speed composting, are optional. Some say that they are necessary to start any composting process and others say they are nothing but "snake oil".

These compost-making guidelines apply in general to the compost used in this field study, which was made in windrows, as well as to several other methods of composting (Alpert, 1987). In windrow systems the material is piled in long rows and aerated by mechanically turning the piles. Static pile systems are similar to windrowing, but the pile

is not turned for aeration. Instead, perforated pipes connected to blowers aerate the piles. Vessel systems are used to compost materials in enclosed areas in "batches".

In this study, a mixture of dairy manure and straw was put into windrows and turned mechanically to maintain desired levels of temperature, O_2, and CO_2. From the preceeding description of the factors involved in compost-making, it should be noted that the whole process is difficult to monitor and to control. The composting process itself was not the focal point for this study, but rather the use of compost versus conventional fertilizer in a cropping system.

Highly soluble inorganic N fertilizers have long been effective in boosting crop growth. If overapplied, as was common in the past, excess soluble N may leach into the groundwater of the surrounding community causing health concerns and degrading environmental quality (Magdoff, 1991a; McCracken et. al., 1989; Roth and Fox, 1990). Carefully selected management strategies, such as those that closely monitor the amounts of N application as compared to N need and those that make better use of organic resources, may decrease N leaching into the environment. One management strategy that makes use of organic resources is composting.

The attributes of compost which make it a possible management strategy as well as possible pitfalls associated with compost are summarized below (Anonymous, 1980; Dick and McCoy, 1993; Land Stewardship Project, 1987; Pfirter et. al., 1981). 1)The nutrient value of well-made compost is about 15-30 lbs of N, 5-10 lbs of phosphate, and 15-30 lbs of potassium per ton. The nutrients in compost are more dilute than when applied as mineral fertilizers, sometimes making it difficult to supply sufficient amounts of nutrients

at reasonable compost application rates, especially in the first few years of compost use. Compost contains trace elements needed by crops that mineral fertilizers do not contain. 2)Composting can reduce the volume of manure and other organic material by 30-50% through the breakdown of organic matter. Reduced volume means less material to haul and so reduces the cost of handling (Logsdon, 1993). If large amounts of C must be added to decrease the C:N ratio of the compost, reduction in volume may not be as significant. 3)Overall farm labor may be reduced in some cases except for short periods of intense compost work to stack and turn the compost in windrows. 4)A major problem at the rural-urban interface is odor complaints. Composting eliminates odor; the "finished" product smells like and has the consistency of soil. 5)In contrast to some inorganic N fertilizers which release N relatively quickly, compost is said to release N slowly. Slow release of N can reduce leaching losses; however, this slow release may not provide adequate N at critical crop growth stages. The amount of N actually available to the crop depends on how much of the N in the compost is in fact mineralized. Mineralization rate is dependent on environmental factors such as moisture, temperature, pH, and soil type. 6)The high temperatures of a windrow can reduce the need for pesticides by killing weed seeds and pathogens. 7)Because compost is organic in nature, it adds organic matter to the soil which improves soil structure. The benefits of decreased bulk density, higher cation exchange capacity, and increased water holding capacity may take several years to develop and may not be cost efficient initially, but are a major advantage of compost in the long run. 8)The use of compost can mean less N leaching losses (Maynard, 1993) because the N in compost is mostly in an organic form and is mineralized over time. 9)Composting

can provide an added source of income if sold in urban markets (Biocycle, 1994), but this is dependent on the price at which compost can be sold and the cost to prepare the compost for market. Because of some of these characteristics, compost has a potential to be used as an alternative to or in conjunction with other management strategies.

Manure management and municipal solid waste composting are two topics related to this study which have been researched far more than on-farm composting. Much knowledge can be gained from the field of manure management as to nutrient availability and soil benefits when trying to implement composting on the farm (Anonymous, 1980; Vitosh et. al., 1990). The knowledge gained by the composting of municipal solid wastes (MSW) can also be used for on-farm composting (O'Keefe et. al., 1986). Numerous studies are being carried out as to the effects of MSW on farmers' fields (Inman et. al., 1982; Mays et. al., 1973). MSW are being hauled to farms to be composted and applied to fields (Henkes and Maynard, 1994).

A management strategy that is used in this study in conjunction with compost is that of cover crops. A common definition is that; "a cover crop is a crop whose main purpose is to benefit the soil and/or other crops in one or more ways, but it is not intended to be harvested for feed or sale" (Anonymous, 1991b). Cover crops can be used to meet different needs in different cropping systems, but there are general benefits associated with cover crop use (Doran and Smith, 1991; Hesterman et. al., 1992). Cover crops reduce soil and wind erosion by protecting the soil when the main crop is absent. Groundwater pollution from NO_3-N leaching can be reduced with cover crops that take up excess N. The effects of cover crops on leaching loss have been reviewed by Meisinger et. al.

(1991). A possible problem related to a reduction in N leaching is that cover crops may compete for moisture and N when these factors are limiting, causing stress to the main crop. Weeds can be controlled when cover crops are planted for competition. Cover crops decrease insect and disease problems by increasing crop diversity. When plowed down, leguminous cover crops can provide some N to subsequent main crops.

Even though herbicides were used, the compost treated plots can be expected to exhibit many of the nutrient release characteristics of a conventionally fertilized system as it converts to an organically managed system. One of the effects found in the conversion to an organically managed system is an initial N deficiency which results in lower yields of crops having high N requirements, such as corn (USDA Study Team on Organic Farming, 1980).

Objectives and Approach:

Two main objectives of this study were to determine: 1) the effect of N source, either compost or conventional fertilizer, on N movement in a cropping system and 2) the effect of cover crops on N movement in a compost versus a fertilizer management system.

The approach used in this study is to test soil samples, lysimeter leachate samples, and plant tissue samples for N. Nitrogen, specifically NO_3, can be easily tested because of its solubility and mobility in soil-plant systems. This study attempts to quantify various "pools" of N present in the cropping systems, except for that which is volatized and that which is in the roots.

MATERIALS AND METHODS

Field Design:

The Living Field Laboratory (LFL) experiment was set up on the Kellogg Biological Station (KBS) site at Hickory Corners, Michigan for the 1993 and 1994 growing seasons (Figure 1). The previous alfalfa crop was plowed down in the fall of 1992 and rye was planted for ground cover over the winter. The soil types in the LFL are Kalamazoo loam (fine-loamy, mixed, mesic Typic Hapludalf) and Oshtemo sandy loam (coarse-loamy, mixed, mesic Typic Hapludalf) (see Appendix A for map). Two crop management systems within the LFL, an integrated compost and an integrated fertilizer system, were compared as to N use efficiency. An integrated system is defined in this study as one in which herbicides and fertilizers are banded, soil tests such as the pre-sidedress nitrate test are employed, several cultivations are used to control weeds, and cover crops and crop rotations are used. Specific field operations for 1992-1994 are listed in Appendix B.

The field design of the Living Field Laboratory is a split-block within a split plot design. Each management type was replicated four times. Within each management type there are five plots each 30 by 50 feet. One plot was continuous corn and the other four had crop rotation entry points using the rotation of corn followed by corn (Pioneer 3751) followed by soybean (BSR 101) followed by wheat (in 1993 Butte 86; in 1994 Augusta). Spring wheat was used in 1993 because the experiment was begun at that time; winter wheat was used in subsequent years. Entry points were configured so that each crop is represented every year. Corn and soybean were planted at a 30 inch row spacing and wheat was drilled at a 7 inch spacing. Throughout the experiment, the corn plots are designated; "1st year corn, 2nd year corn, and continuous corn" as to their place in the rotation for future reference even though in the initial year of the experiment there obviously is no "2nd year corn" for example.

Each crop rotation plot is divided so that the west half of the plot has a cover crop and the east half of the plot does not. Cover crops were broadcast using a hand seeder. In

FIELD SIZE
(plot borders)
340' x 760'

N

PLOT SIZE
30' x 50'

TOP NUMBER = PLOT ID

BOTTOM NUMBER ( ) =

1st number

Management Type
1=organic-cover crops no pesticides
2 = integrated/compost- cover crops, low pesticide
3 = integrated/fertilizer- cover crops, low pesticide
4=conventional-full chemical, no cover crops

2nd number

Rotation				
	93	94	95	96
1	c	sb	w	c
2	sb	w	c	c
3	w	c	c	sb
4	c	c	sb	w
5	continuous corn			

w = wheat c = corn
sb = soybean

3rd number

Lysimeter Placement
0 = None
1 = 12" Lysimeter
2 = 12" and 30" Lysimeter

COVER CROPS
Wheat- red clover
1st Year Corn - annual ryegrass/legume
2nd Year Corn- annual ryegrass
Continuous Corn- annual ryegrass/legume
A = cover
B = no cover

Figure 1. Living Field Laboratory plot plan.

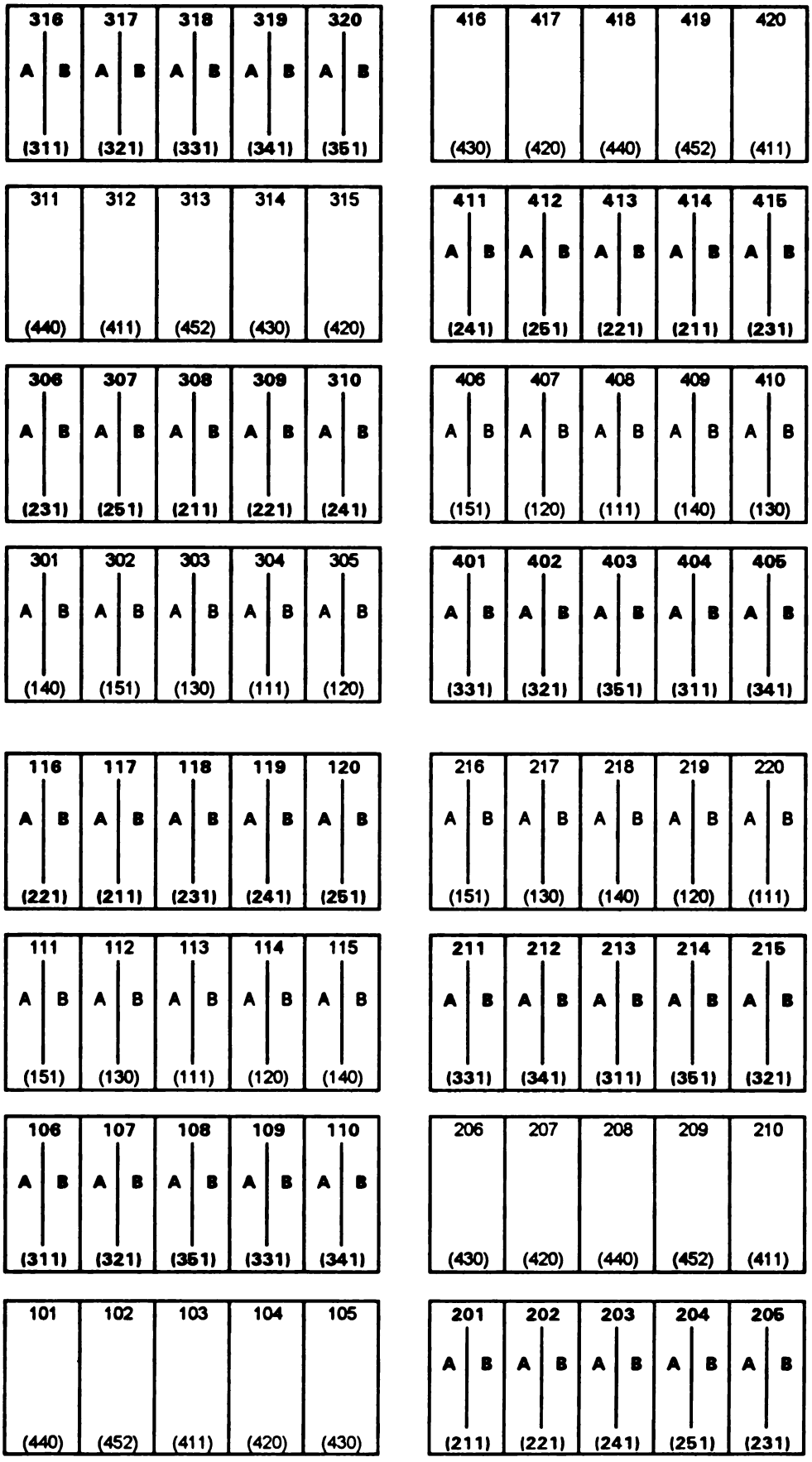

Figure 1. Living Field Laboratory plot plan.

1993 the cover crops were: a mixture of annual ryegrass (*Lolium multiflorum* Lam.) and hairy vetch (*Vicia villosa* Roth) in corn followed by corn and in continuous corn; annual ryegrass in corn followed by soybean; and Michigan mammoth red clover (*Trifolium pratense* L.) in wheat followed by corn. Red clover was seeded into spring wheat in May of 1993 and frost seeded into winter wheat in March of 1994. Cover crops were seeded into corn in mid June. In 1994, Michigan mammoth red clover was substituted for hairy vetch in the annual ryegrass-hairy vetch mixture because hairy vetch was inadequate and unpredictable. In this study the role of annual ryegrass is to take up excess N and decrease N leaching losses. The role of hairy vetch and red clover is to provide supplemental N to the subsequent main crop.

Lysimeters (Brinsfield and Staver, 1991) were installed in the west half of each plot, which is the half of the plot with a cover crop present. The lysimeters (Figure 2) are intact core lysimeters and are one foot underground to allow normal field operations to occur.

Rainfall data was acquired from the KBS pond lab site and is summarized in Appendix C. No soil physical measurements such as penetrometer readings or bulk density were taken because the changes measured by these tests are long term, whereas this initial two year study is short term. Therefore, these measurements would not be feasible or meaningful for this study, but need to be studied in future research.

Crop Management Systems:

Fertilizer was applied according to the recommendations given from the analysis of soil samples and the yield goal of each crop (Christenson et. al., 1992). Nitrogen fertilizer was applied to the corn in two applications, at planting as a starter and at sidedress in mid June. The wheat was fertilized in two applications, at planting in the fall and in the spring. The soil samples used for testing soil fertility were taken in early spring, in June for sidedress application in corn, and in the fall. Five one-foot cores were composited from each plot. In 1993, these samples were further composited by management type and crop

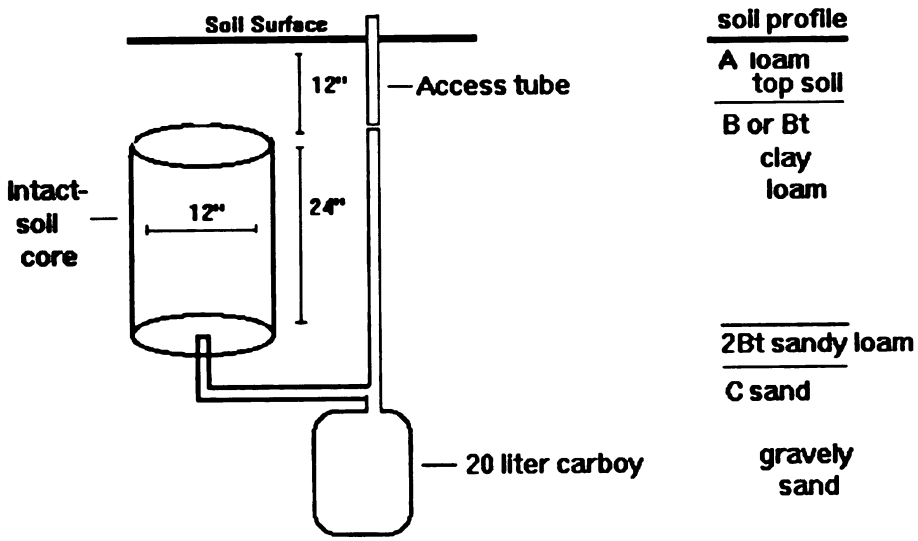

Figure 2. Lysimeter diagram.

(i.e. all of the fertilized corn from each rep, regardless of cover crop, was composited; all of the fertilized wheat from each rep was composited). In 1994, the corn samples were not composited regardless of cover crop, but the crop rotation plots were kept separate (i.e. fertilized corn was split into three groups depending on the cover crop present and so was composited by management type, cover crop treatment, and rep). In the initial two years, the cover crop and no cover crop halves of the crop rotation plots were also composited, and the plots were fertilized based on the nutrient requirements of the half of the plot without a cover crop. The cover crops were given no N credit. Applying fertilizer (or compost) to the whole plot on the basis of the N requirements of the grain crop, excluding any N needs of the cover crops, allowed us to determine what effect cover crops may have had on the soil N mineralization over the season.

Compost was applied with regard to the soil sample and in general accordance with the yield goal of each crop. Soil samples were taken in the same way and with similar reasoning for the compost treated plots as that described above for the fertilized plots. Compost application was more challenging than fertilizer application in that when applying soluble fertilizer, we were relatively sure of the amount of N available to the crop; however, we were unsure about N availability and mineralization in compost. The amount of N available in the first year was estimated to be 15%. The reasoning behind this estimation was that 25-35% of N in dairy manure is estimated to be available in the first year (Vitosh et. al., 1990), whereas the N in compost is more decomposed and therefore more stable or in a less available form than the N in raw dairy manure. Compost application rate also took into account the % moisture and the total % N present, as well as the 15% N estimated to be available in the first year. Compost was applied on the basis of N requirements, but also had to take the estimated amount of P and K into account. Compost was applied on a dry weight basis over all plots for all crop types in 1993, but not to soybean plots in subsequent years. Wheat plots received compost in the fall. Corn and soybean received compost in the spring. Compost was incorporated prior to planting

Table 1. Compost analysis

	APPLICATION DATE			
	4/22/93[1]	10/18/93[2]	4/21/94[3]	10/4/94[4]
Compost applied (wet lbs/a)	7600	65900	75300	67700
Compost applied (dry lbs/a)	3200	45500	39900	56800
Nitrogen supplied (lbs/a)	40	190	600	440
Estimated available lbsN/a (15%)	<10	30	90	70
Nitrogen (%)	1.2	0.4	1.5	0.8
Carbon (%)	14.1	6.2	20.2	10.2
C:N ratio	12	15	13	13
Nitrate-Nitrogen (ug/ml)			4	13
	----------%			
Phosphorus	0.5	0.2	0.4	0.2
Potassium	0.3	0.5	1.7	0.8
Calcium	1.0	2.2	2.3	14.0
Magnesium	0.4	0.6	0.5	1.8
	----------ppm----------			
Boron	10	20	50	40
Zinc	220	50		
Manganese	210	100	190	420
Copper	130	20		
Iron	2770	1510	0.2(%)	0.6(%)
Aluminum	2330	990		
Sodium	200	1270	0.2(%)	740
pH			8.4	9.2
Electrical conductivity (mmhos/cm)			5.5	11.6
Moisture (%)	60	30	50	20

[1]applied to all crops, lab analysis by MSU,

[2] applied to wheat, lab analysis by MSU

[3]applied to corn, lab analysis by Ohio State,

[4]applied to wheat, lab analysis by Ohio State.

the crop. As seen in Table 1, compost composition and rate varied with each application. Compost applied in the fall of 1993 and in 1994 contained sand from dairy bedding which reduced the nutrient concentration in those applications. Nitrogen amounts in compost treated plots were not necessarily the same as that in fertilized plots, depending on how well we estimated the available N, and this will affect interpretation of the data.

Yield Determination and Biomass N Sampling:

Soybean grain yield in each plot was determined by harvesting 10 rows by 50 feet in 1993 and 2 rows by 50 feet in 1994. Grain yield for each wheat plot was determined by harvesting 49 inches by 50 feet. Corn ears were hand harvested from two 20-foot long random rows in each plot. The grain was shelled from the cob, weighed, and tested for moisture to determine corn yield.

A total above ground biomass sample was taken from each crop just before its harvest, and plant dry weight was measured (Shipley et al., 1992). Plant tissue samples were dried and ground to be analyzed for %N with a mass spectrometer. Percent N was later converted to lbs N/acre by multiplying the biomass dry weight in an acre by the %N. Five feet of a random row was collected in each soybean plot prior to leaf drop. Soybean were threshed so the beans and stover were analyzed separately. A two square yard section was collected from each wheat plot. In 1993, the whole wheat plant was separated from the weeds for drying and weighing. In 1994, there were not enough weeds to separate from the wheat. Ten random stalks were collected from each corn plot. An inch cross section was cut from each ear and dried, ground, and analyzed for %N. The stover, including ear husk, was chopped, dried, and ground to be analyzed for %N as well. Two random samples were collected from each of the cover crop plots prior to grain harvest using a square frame 10.75 inches on each side.

Crop yield and crop biomass N samples were analyzed using a split-block design within each crop, and cover crop biomass N samples were analyzed using a randomized complete

block design within each crop (see Tables D.1-D.3. for example ANOVA results). Both of these analyses, as well as the following analyses of soil and lysimeter data, were subsets of the overall experimental design selected for the treatments pertinent to this study (Little and Hills, 1978; Ries, 1994).

Soil Samples:

Soil samples were taken 12 times in 1993 and 7 times in 1994. The sampling dates for 1993 were: April 14, May 6, May 19, May 26, June 3, June 11, June 16, July 14, Aug. 17, Sept. 16, Sept. 30, and Oct. 27. The sampling schedule was modified for 1994 to be: April 11, May 4, May 18, June 10, July 11, Oct. 3, and Nov. 8. In the first spring sampling and last fall sampling of each year, three 2-inch cores from both sides of each plot were sampled to a depth of three feet and divided into three one-foot deep sections. Only the top 1 foot section was used in this study to compare with the remaining samples over the season, which were five 0.75 inch cores taken to a depth of one foot. The samples were dried at 100 °F. The dried samples were processed through a 10 mesh screen prior to analysis (Magdoff, 1991b).

Soil samples were extracted for soluble N, that is NO_3 and NH_4, using a method (Keeney and Nelson, 1982) modified in the following way. The samples were diluted in a ratio of 10g of soil to 50ml of 1 N KCl, shaken at 180 oscillations per minute for 1/2 hour, allowed to settle for 15 minutes, and filtered through Whatman No.1 paper. Filtrates were analyzed for NO_3 and NH_4 using the Lachat auto analyzer and reported in ppm.

Soil data were analyzed using a split-block within a split plot design on each date to determine effect of management type, grain crop, and cover crop (ex. Table D.4.). Data were analyzed using a split-block design within each crop for each date of sampling to determine effect of management type and cover crop as shown in Table D.5. (Little and Hills, 1978; Ries, 1994).

Lysimeter Samples:

In the summer of 1992, forty intact-core lysimeters, each with a leachate collection reservoir having a removable access tube (Figure 2), were installed in the west, or cover crop, half of the plot. The removable access tubes allow uniform cultivation within the 1 foot zone directly above the lysimeters. Lysimeters were pumped dry on Nov. 24, 1992 to begin the first sampling period. Lysimeters were then pumped in 1993 on Jan. 11, March 2, April 12, June 10, July 7, Sept. 22, Oct. 26, and Nov. 30. In 1994, the lysimeters were pumped on March 2, April 4, June 27, July 29, Aug. 29, Oct. 21 and Dec. 5. Sampling was to have been done monthly, but was modified because of cultivation and unfavorable weather. At each pumping the volume of leachate was recorded. A subsample was analyzed for total soluble N (NO_3 and NH_4 in ppm) using the Lachat auto analyzer (Bergstrom, 1987; Martinez and Guiraud, 1990). Daily precipitation was obtained from the weather station at KBS and summarized in Appendix C. The volume of leachate was divided by the surface area of the lysimeter soil core, multiplied by the pounds of water in an acre-inch, and multiplied by the ppm to come up with pounds of NO_3-N per acre. The lysimeters are still settling in the soil because they were installed only 3-6 months before this study, which makes it difficult to draw any specific solid conclusions from the data.

Lysimeter data were analyzed using a split plot design on each sampling date to evaluate effect of management type and grain crop on NO_3-N losses (ex. Table D.6.). Data were also analyzed using a randomized complete block design within each crop on each sampling date to evaluate effect of management type alone, as shown in Table D.7. (Little and Hill, 1978; Ries, 1994).

RESULTS

Yield and Above-ground Biomass N:

As seen in Table 2, in 1993 management type was significant in the yield of soybean, 1st year corn, and 2nd year corn. Compost treated soybean had a significantly higher yield than fertilized soybean, whereas fertilized 1st and 2nd year corn yielded significantly higher than their compost treated counterparts. No significant differences in yield were found whether or not cover crops were present. Fertilized 1st year and continuous corn had significantly higher biomass N than compost treated corn (Table 3). No significance was found in cover crop biomass N.

In 1994, only the yield of 2nd year corn was significantly different in both management type and cover (Table 2). Fertilized 2nd year corn yielded significantly higher than compost treated 2nd year corn. Second year corn without a cover crop yielded significantly higher than 2nd year corn with a cover crop. The biomass N of fertilized 2nd year corn was significantly higher than compost treated corn (Table 3). One cover crop, red clover frost seeded into wheat, had significantly higher biomass N in the compost treated plots than in the fertilized plots. (See Appendix E for raw data)

Table 2. Crop yield comparing management type and cover crop in 1993 and 1994.

Grain Crop	Management Type		Cover Crop	
	Compost	Fertilizer	Cover	No Cover
	bu/a			
		1993		
Soybean	51	45 *	48	48 [1]
Wheat	23	18	21	21 [1]
1st yr corn	132	157 **	144	145
2nd yr corn	129	161 *	143	147
Continuous corn	126	155	142	139
		1994		
Soybean	47	39	41	45
Wheat	47	47	47	47
1st yr corn	186	188	189	185
2nd yr corn	118	167 **	132	153 **
Continuous corn	122	139	133	128

* P <= 0.05, ** P <= 0.01

[1]plots not split because no cover crop was seeded

Table 3. Crop above-ground biomass N comparing management type and cover crop in 1993 and 1994.

Crop	Management Type		Cover Crop	
	Compost	Fertilizer	Cover	No Cover
	lbs N/a			
Grain		**1993**		
Soybean	191	169	180	180 [1]
Wheat	33	38	34	36
1st yr corn	61	112 *	82	92
2nd yr corn	66	84	75	76
Continuous corn	65	105 **	78	92
Cover				
clover in wheat	26	28		
ry/v in 1st yr corn[2]	3	6		
ry in 2nd yr corn	5	9		
ry/v in cont corn	5	7		
Grain		**1994**		
Soybean	135	134	126	143
Wheat	40	63	53	50
1st yr corn	203	219	215	206
2nd yr corn	94	221 *	143	172
Continuous corn	111	147	122	137
Cover				
clover in wheat	71	28 *		
ry/cl in 1st yr corn[2]	21	16		
ry in 2nd yr corn	12	20		
ry/cl in cont corn	23	28		

* P <= 0.05, ** P <= 0.01

[1]plots not split because no cover crop was seeded

[2]ry=annual ryegrass, v=hairy vetch, cl=red clover

Soil Data:

Although NH_4-N was tested at the same time as NO_3-N, only NO_3-N (in ppm) data were used in the statistical analyses because NH_4-N amounts were not expected to be significant and were in fact minimal (NH_4-N: 1993 mean 6.26 lbs/acre; 1994 mean 3.31 lbs/acre). When averaged across all five crop treatments, 1993 and 1994 fertilized plots appeared to have more NO_3-N present in the soil than compost treated plots, but the differences were significant on only four dates.

When considering the means on each date in 1993, fertilized plots had significantly higher amounts of NO_3-N than compost treated plots on June 11 and July 14 (Table 4). The fertilized plots appeared to have consistently more available NO_3-N than the compost treated plots, though this was not significant. The cover crops showed no significant NO_3-N differences in 1993.

When considering means on each date in 1994, fertilized plots had significantly more available NO_3-N on May 18 and Nov. 8 than compost treated plots (Table 4). All of the fertilized plots appeared to have more available NO_3-N than compost treated plots. In 1994, plots without a cover crop had significantly higher amounts of NO_3-N on May 4 and Nov. 8.

Considering each crop separately in 1993, only management type caused significant differences in soil NO_3-N levels (Table 5). Fertilized plots had significantly higher NO_3-N levels than compost treated plots in wheat on June 3 and June 11, in 1st year corn on July 14 and Oct. 27, in 2nd year corn on April 14 and July 14, and in continuous corn on May

Table 4. Soil NO_3-N comparing management type and cover crop on each date.

Date	Management Type		Cover Crop	
	Compost	Fertilizer	Cover	No Cover
	ppm NO_3-N			
1993				
4/14	2.6	3.1	2.9	2.9 [1]
5/6	4.2	5.7	4.9	4.9 [1]
5/19	8.9	11.7	10.2	10.4
5/26	10.8	10.7	10.8	10.7
6/3	10.0	12.6	10.5	11.2
6/11	8.2	10.8 *	9.5	9.4
6/16	8.9	10.9	7.0	6.6
7/14	4.4	8.7 ***	6.7	6.5
8/17	2.3	5.2	3.2	4.3
9/16	4.5	6.9	5.7	5.7
9/30	3.9	4.3	4.3	3.9
10/27	3.3	3.4	3.1	3.6
1994				
4/11	4.3	6.2	4.5	6.1
5/4	3.8	5.2	4.1	4.8 *
5/18	3.9	5.6 ***	4.4	5.1
6/10	5.6	7.0	6.3	6.3
7/11	3.8	6.6	5.2	5.3
10/3	3.2	3.7	3.3	3.5
11/8	3.8	4.6 *	3.8	4.6 **

* $P <= 0.05$, ** $P <= 0.01$, *** $P <= 0.001$

[1] plots not split because no cover crop was seeded

Table 5. Soil NO_3-N comparing management type and cover crop for each crop on each date.

Date / Crop	Management Type		Cover Crop	
	Compost	Fertilizer	Cover	No Cover
	ppm NO_3-N			
	1993			
4/14				
Soybean	2.4	2.0	2.2	2.2 [1]
Wheat	2.8	3.4	3.1	3.1 [1]
1st yr corn	3.3	4.0	3.7	3.7 [1]
2nd yr corn	1.8	3.1 *	2.5	2.5 [1]
Continuous corn	2.9	3.1	3.0	3.0 [1]
5/6				
Soybean	3.2	4.9	4.0	4.0 [1]
Wheat	5.0	8.5	6.7	6.7 [1]
1st yr corn	5.2	6.0	5.6	5.6 [1]
2nd yr corn	3.5	3.9	3.7	3.7 [1]
Continuous corn	4.1	5.1 *	4.6	4.6 [1]
5/19				
Soybean	8.2	8.1	8.1	8.1 [1]
Wheat	10.4	20.3	15.1	15.8
1st yr corn	10.1	11.1	10.6	10.6 [1]
2nd yr corn	6.8	9.4	8.1	8.1 [1]
Continuous corn	8.9	9.5	9.2	9.2 [1]
5/26				
Soybean	11.8	9.7	10.8	10.8 [1]
Wheat	5.1	13.2	9.5	8.8
1st yr corn	10.4	10.9	10.7	10.7 [1]
2nd yr corn	13.3	8.1	10.7	10.7 [1]
Continuous corn	13.3	11.5	12.4	12.4 [1]
6/3				
Soybean	11.4	9.2	10.3	10.3 [1]
Wheat	7.2	15.8 **	9.8	13.2
1st yr corn	10.4	14.7	10.3	10.3 [1]
2nd yr corn	11.4	10.9	11.2	11.2 [1]
Continuous corn	9.5	12.6	11.1	11.1 [1]

Table 5 (cont'd).

6/11				
Soybean	9.2	9.3	9.2	9.2 [1]
Wheat	2.1	13.7 **	8.1	7.7
1st yr corn	9.6	10.5	10.1	10.1 [1]
2nd yr corn	9.4	9.3	9.3	9.3 [1]
Continuous corn	10.5	11.1	10.8	10.8 [1]
6/16				
Soybean	8.9	9.0	7.4	7.4 [1]
Wheat	2.5	10.4	5.9	3.9
1st yr corn	10.7	12.4	5.8	5.8 [1]
2nd yr corn	11.4	10.6	6.9	6.9 [1]
Continuous corn	10.9	12.0	8.8	8.8 [1]
7/14				
Soybean	7.8	7.8	7.8	7.8 [1]
Wheat	1.6	2.5	2.2	2.0
1st yr corn	4.6	10.0 *	6.9	7.6
2nd yr corn	4.0	10.9 ***	6.9	6.5
Continuous corn	3.9	12.5 *	9.6	6.8
8/17				
Soybean	3.0	3.1	3.0	3.0 [1]
Wheat	2.7	4.2	2.9	3.9
1st yr corn	2.0	9.0	3.1	7.9
2nd yr corn	2.1	4.2	3.4	3.0
Continuous corn	1.9	5.3	3.7	3.6
9/16				
Soybean	4.7	6.3	5.5	5.5 [1]
Wheat	5.0	5.9	5.3	5.7
1st yr corn	4.3	8.1	6.4	6.0
2nd yr corn	4.1	6.3	5.4	5.0
Continuous corn	4.5	7.6 *	6.1	6.1
9/30				
Soybean	3.8	3.8	3.8	3.8 [1]
Wheat	3.4	5.0	4.3	4.1
1st yr corn	3.7	4.7	3.9	4.5
2nd yr corn	5.4	3.6	5.5	3.5
Continuous corn	3.0	4.3	3.7	3.6

Table 5 (cont'd).

10/27				
Soybean	5.3	3.3	3.7	4.9
Wheat	3.0	3.1	3.5	2.7
1st yr corn	3.1	4.5 *	3.2	4.5
2nd yr corn	2.4	2.9	2.4	2.9
Continuous corn	2.8	3.1	2.8	3.1
		1994		
4/11				
Soybean	3.9	5.4	4.3	5.1
Wheat	5.1	8.5	6.9	7.3
1st yr corn	4.7	5.9	4.4	6.2
2nd yr corn	3.3	5.8 *	3.2	5.9
Continuous corn	4.6	5.4	3.9	6.1
5/4				
Soybean	3.3	4.2 *	2.9	4.6 **
Wheat	2.6	9.3 *	5.8	6.1
1st yr corn	5.7	3.6	5.3	4.0
2nd yr corn	3.5	4.7 *	3.3	4.9 **
Continuous corn	3.7	4.2	3.3	4.5 **
5/18				
Soybean	3.6	4.6	3.4	4.8 **
Wheat	1.6	4.9 *	3.3	3.2
1st yr corn	6.6	7.3	7.5	6.5
2nd yr corn	3.6	6.2 **	4.1	5.7 **
Continuous corn	4.1	5.0	3.9	5.1
6/10				
Soybean	5.9	8.1	6.9	7.0
Wheat	2.5	4.2	3.9	2.8
1st yr corn	9.0	9.8	9.5	9.2
2nd yr corn	5.0	6.5	5.6	5.9
Continuous corn	5.6	6.5	5.8	6.4
7/11				
Soybean	4.1	4.5	3.9	4.6
Wheat	3.6	3.6	3.2	4.1
1st yr corn	4.3	9.5 *	7.0	6.8
2nd yr corn	3.3	9.4 *	6.7	6.1
Continuous corn	4.0	6.0	5.2	4.7

Table 5 (cont'd).

10/3				
Soybean	3.5	5.2	3.5	5.3
Wheat	3.1	1.9	2.8	2.0
1st yr corn	1.6	2.4	2.0	2.0
2nd yr corn	3.3	6.3	4.9	4.7
Continuous corn	4.3	2.6	3.5	3.4
11/8				
Soybean	6.0	6.3	5.2	7.1 **
Wheat	3.6	4.3	3.8	4.1
1st yr corn	3.0	4.5 *	3.2	4.2
2nd yr corn	2.8	4.3 **	3.9	3.1
Continuous corn	3.5	3.8	3.0	4.3

* P <= 0.05, ** P <= 0.01, *** P <= 0.001

[1]plots not split because no cover crop was seeded

6, July 14 and Sept. 16. All three fertilized corn treatments had significantly higher NO_3-N levels than compost treated corn on July 14, 1993.

Considering each crop separately in 1994, both management type and cover crop showed some significant differences (Table 5). Fertililized plots had significantly higher NO_3-N levels than compost treated plots in soybean on May 4, in wheat on May 4 and May 18, in 1st year corn on July 11 and Nov. 8, and in 2nd year corn on April 11, May 4, May 18, July 11, and Nov. 8. Plots without a cover crop had significantly higher NO_3-N levels than plots with a cover crop in soybean on May 4, May 18, and Nov. 8, in 2nd year corn on May 4 and May 18, and in continuous corn May 4. (See Appendix F for raw data)

Lysimeter Data:

Even though NH_4-N was tested at the same time as NO_3-N, only NO_3-N (in lbs/acre) data were used in the statistical analyses because NH_4-N is not expected to leach and amounts found were very small (1993 mean 0.67 lbs/acre; 1994 mean 0.13 lbs/acre). The great variability of the lysimeter data make specific results questionable. In 1993 the NO_3-N that was lost through the lysimeters in compost and in fertilizer was relatively similar. When looking at the mean on each date in 1993 (Table 6) no significant difference between compost and fertilizer were found. In 1994 fertilized plots had significantly more NO_3-N lost from Dec. 1 - March 2 and from March 3 - April 4. All the fertilized plots appeared to have consistently more NO_3-N losses than the compost treated plots in 1994.

Table 6. Lysimeter leachate NO_3-N comparing management type at each pumping and per day.

Dates	Management Type			
	Compost	Fertilizer	Compost	Fertilizer
	lbs NO_3-N/acre			
	1993			
			per day[1]	
11/25 - 1/11	18.9	23.5	0.4	0.5
1/12 - 3/2	6.2	5.5	0.1	0.1
3/3 - 4/12	9.6	5.3	0.2	0.1
4/13 - 6/10	15.3	11.8	0.3	0.2
6/11 - 7/7	8.8	12.2	0.3	0.5
7/8 - 9/22	3.8	2.4	0.1	0.0
9/23 - 10/26	5.3	6.5	0.2	0.2
10/27 - 11/30	1.3	0.8	0.0	0.0
	1994			
			per day[1]	
12/1 - 3/2	10.0	20.5 *	0.2	0.2
3/3 - 4/4	3.0	8.8 **	0.1	0.3
4/5 - 6/27	5.8	10.2	0.1	0.1
6/28 - 7/29	1.9	3.5	0.1	0.1
7/30 - 8/29	0.5	4.0	0.0	0.1
8/30 - 10/21	1.1	1.6	0.0	0.0
10/22 - 12/5	1.4	6.0	0.0	0.1

* $P <= 0.05$, ** $P <= 0.01$

[1]numbers are calculated by dividing each of the first two columns by the number of days between each pumping

Table 7. Lysimeter leachate NO_3-N comparing management type at each pumping and per day for each crop.

Dates	Management Type			
Crop	Compost	Fertilizer	Compost	Fertilizer
	lbs NO_3-N/acre			
	1993			
			per day[1]	
11/25 - 1/11				
Soybean	10.8	13.0	0.2	0.3
Wheat	26.3	6.2	0.6	0.1
1st yr corn	28.1	26.1	0.6	0.5
2nd yr corn	10.9	57.0	0.2	1.2
Continuous corn	18.3	15.3	0.4	0.3
1/12 - 3/2				
Soybean	2.4	7.6	0.1	0.2
Wheat	0.6	1.2	0.0	0.0
1st yr corn	3.7	2.9	0.1	0.1
2nd yr corn	19.2	10.0	0.4	0.2
Continuous corn	4.8	5.9	0.1	0.1
3/3 - 4/12				
Soybean	6.2	3.1	0.2	0.1
Wheat	19.9	2.7	0.5	0.1
1st yr corn	6.8	4.7	0.2	0.1
2nd yr corn	10.3	14.2	0.3	0.4
Continuous corn	5.0	1.6	0.1	0.0
4/13 - 6/10				
Soybean	9.3	14.1	0.2	0.2
Wheat	8.3	7.3	0.1	0.1
1st yr corn	25.7	14.8	0.4	0.3
2nd yr corn	27.2	14.1	0.5	0.2
Continuous corn	6.1	8.9	0.1	0.2
6/11 - 7/7				
Soybean	13.4	16.5	0.5	0.6
Wheat	0.2	0.9	0.0	0.0
1st yr corn	14.7	15.0	0.6	0.6
2nd yr corn	10.2	14.8	0.4	0.6
Continuous corn	5.3	13.7	0.2	0.5
7/8 - 9/22				
Soybean	9.6	3.9	0.1	0.1
Wheat	1.0	0.5	0.0	0.0
1st yr corn	3.1	1.3	0.0	0.0
2nd yr corn	2.0	3.9	0.0	0.1
Continuous corn	3.5	2.5	0.0	0.0

Table 7 (cont'd).

9/23 - 10/26				
Soybean	11.9	5.7	0.4	0.2
Wheat	4.7	4.4	0.1	0.1
1st yr corn	0.8	2.1	0.0	0.1
2nd yr corn	7.1	8.1	0.2	0.2
Continuous corn	2.1	12.0	0.1	0.4
10/27 - 11/30				
Soybean	0.3	1.2	0.0	0.0
Wheat	0.8	0.6	0.0	0.0
1st yr corn	0.3	0.1	0.0	0.0
2nd yr corn	4.1	0.9	0.1	0.0
Continuous corn	0.8	1.1	0.2	0.0
		1994		
			per day[1]	
12/1 - 3/2				
Soybean	3.7	22.0	0.0	0.2
Wheat	3.6	7.6	0.0	0.1
1st yr corn	25.2	23.0	0.3	0.3
2nd yr corn	6.7	30.6	0.1	0.3
Continuous corn	11.0	19.4	0.1	0.2
3/3 - 4/4				
Soybean	2.7	6.0	0.1	0.2
Wheat	1.1	0.5	0.0	0.0
1st yr corn	7.9	12.3	0.2	0.4
2nd yr corn	2.2	10.9	0.1	0.3
Continuous corn	1.3	14.2	0.0	0.4
4/5 - 6/27				
Soybean	6.7	24.9 *	0.1	0.3
Wheat	0.1		0.0	
1st yr corn	10.8	7.8	0.1	0.1
2nd yr corn	7.2	8.8	0.1	0.1
Continuous corn	4.2	9.4	0.1	0.1
6/28 - 7/29				
Soybean	2.4	2.9	0.1	0.1
Wheat	0.5		0.0	
1st yr corn	4.4	9.9	0.1	0.3
2nd yr corn	1.2	2.5	0.0	0.1
Continuous corn	1.2	2.4	0.0	0.1
7/30 - 8/29				
Soybean	0.9	1.0	0.0	0.1
Wheat	0.8	2.2	0.0	0.1
1st yr corn		11.4		0.4
2nd yr corn	0.7	5.3	0.0	0.2
Continuous corn	0.3	0.2	0.0	0.0

Table 7 (cont'd).

8/30 - 10/21				
Soybean	1.5	0.7	0.0	0.0
Wheat	0.2	2.6	0.0	0.1
1st yr corn	3.4	1.5	0.1	0.0
2nd yr corn	0.3	1.2	0.0	0.0
Continuous corn	0.4	1.9	0.0	0.0
10/22 - 12/5				
Soybean	1.1	6.7	0.0	0.2
Wheat	2.0	2.8	0.0	0.1
1st yr corn	2.7	3.7	0.1	0.1
2nd yr corn	0.7	12.5	0.0	0.3
Continuous corn	0.2	4.2	0.0	0.1

* $P <= 0.05$

[1]numbers are calculated by dividing each of the first two columns by the number of days between each pumping

Considering each crop separately (Table 7), only one crop on one out of 15 sampling dates showed any significant differences. From April 5 - June 27, 1994, fertilized soybeans leached significantly more NO_3-N than did compost treated soybeans. No other significant differences in NO_3-N leaching losses between compost treated and fertilized plots were found. (See Appendix G for raw data)

DISCUSSION

Yield and Above-ground Biomass N:

Higher grain and above-ground biomass N yields in 1994 as compared to 1993 (except for soybean) may be due to more optimal growing conditions (Figures 3 and 4 and Figures H.1. and H.3.). Only soybean yielded higher and had more biomass N when compost treated than when fertilized. The reason for higher yields in compost treated soybean is unclear. Wheat yield increase from 1993 to 1994 was because of a change from spring to winter wheat. Wheat yield was not significantly affected by whether its N source was compost or fertilizer. Although wheat had higher biomass N in fertilized plots, grain yields were slightly higher in compost treated plots (though not significant).

In 1994, 1st year corn following wheat yielded the highest of the corn plots, and was not affected by management type or cover crop treatment. Lower yields in 2nd year and continuous corn corn were probably because of lower N availability following depletion by the previous corn crop. Fertilized corn yielded higher and had higher biomass N than compost treated plots perhaps because corn requires a lot of N compared to the other crops in the rotation. Compost treated plots did not supply adequate N for a second crop of corn even with a cover crop present. When applying soluble mineral fertilizer, one is relatively certain of the amounts of N needed to produce desired yields, but this is not the case with compost. The 15% N availability estimate failed to produce the desired yields, so according to the results from this study a 15% N availability estimate is not adequate to produce desired yields in corn following corn.

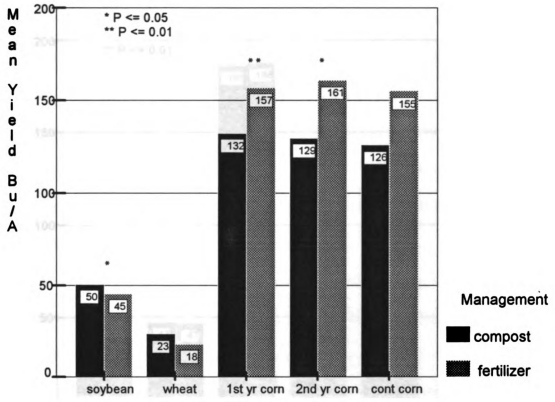

Figure 3. Grain yield for compost versus fertilizer in 1993.

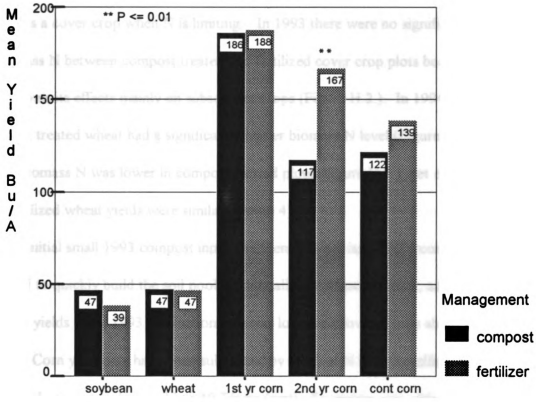

Figure 4. Grain yield for compost versus fertilizer in 1994.

In general the half of the plot without a cover crop yielded higher and had more biomass N than the half of the plot with a cover crop. Lower yields and biomass N with cover crops may be because the cover crops competed with the main crop for the moisture and the N that was available during the critical growth stages of the crop. Annual ryegrass, which has been reported to be an effective N scavenger, may not be a good choice as a cover crop when N is limiting. In 1993 there were no significant differences in biomass N between compost treated and fertilized cover crop plots because a cover crop shows its effects mainly on subsequent crops (Figure H.2.). In 1994, red clover in compost treated wheat had a significantly higher biomass N level (Figure H.4.), and the wheat biomass N was lower in compost treated plots (Figure H.3.), yet compost treated and fertilized wheat yields were similar (Figure 4).

The initial small 1993 compost input and then the very large 1994 compost input intended to quickly build the soil pool of mineralizable organic matter, adversely affected the corn yields. The 1993 application rate was low and provided only about 6 lbs of N/acre. Corn yield may have been subsidized by residual N from the alfalfa plowed down in 1992. In the second year, 30 to 40 T/acre (wet) of compost was added to the plots. Large applications of compost, though intended to build up mineralizable N, may in fact cause a deficiency as microorganisms require large amounts of the N to breakdown the compost itself. Immobilization of N by microorganisms was probably not the problem in this case because the C:N ratio of the compost ranged between 12 to 15. The N content ranged between 0.41% to 1.5%. More careful monitoring of the compost and more

experience in compost management is needed to ensure that corn yields do not decrease when using compost as a nutrient source.

Soil NO_3-N:

Ideally, a soil NO_3-N curve (ppm NO_3-N) over a growing season should show an adequate amount of available NO_3-N early in the season at critical growth stages of the crop and a gradual decrease over the season until there is very little NO_3-N left in the soil to be a potential leaching problem over the winter. This ideal curve is similar to the data in Figure 5. Although overall soil NO_3-N values were below those expected, soil NO_3-N curves in the LFL were similar to the ideal curve (Figures H.5.-H.13.). Compost treated plots had less available soil NO_3-N than fertilized plots, though this was significant only on a few dates. Lower NO_3-N availablility than estimated in the compost treated plots may be because compost releases N more slowly over time and N mineralization depends on environmental factors such as moisture and temperature.

Soybean and wheat yields were unaffected by lower soil NO_3-N in compost treated plots. Greater available soil NO_3-N in fertilized corn plots did show up in higher corn yields. Compost treated wheat yield may be less affected by low N than compost treated corn yield simply because wheat has a lower N requirement than corn at the yield levels achievable at this location. Perhaps corn should not be used in the initial years of compost use because of its high N requirements. Liebhardt et al. (1989) stated that corn, which requires high N levels, should not be grown in the first several years when changing from a conventionally managed to an organically managed system (i.e. from using chemical inputs

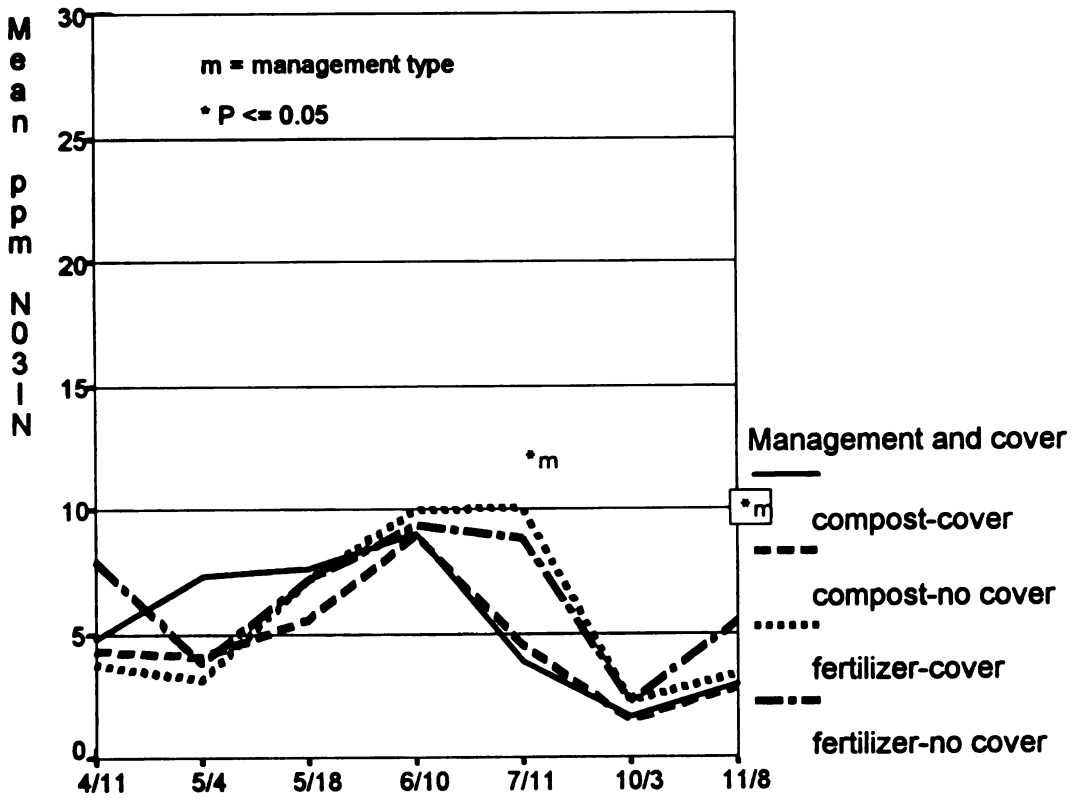

Figure 5. Soil NO3-N of 1st yr corn with ryegrass/clover in 1994.

to using organic inputs). Although red clover in wheat showed significantly higher biomass N in compost treated plots, no significant difference in soil NO_3-N was found. Preliminary laboratory incubation tests of soil NO_3-N mineralization potential from June 1994 (T.C. Willson, 1995, personal communication) show that initially there was a higher amount of NO_3-N available in fertilized plots, but that later in the incubation a similar amount of NO_3-N was present in compost treated and fertilized plots.

Lysimeter NO_3-N:

Ideally, lysimeter NO_3-N data (lbs NO_3-N/acre) would show little leaching at any time of the year especially in the fall when the most leaching usually takes place. Lysimeter NO_3-N values were extremely variable, so the lysimeter data was difficult to interpret. Compost neither decreased nor increased NO_3-N leaching in 1993 (Figure H.14.). In the spring of 1994 fertilized plots leached significantly higher amounts of NO_3-N than compost treated plots. Overall in 1994 less NO_3-N was leached from compost treated plots than from fertilized plots (Figure 6). A few more years of lysimeter data are needed to draw more specific conclusions.

Summary:

Except for a few significantly lower corn yields, compost yields and biomass N grown on compost treated soils were comparable to those grown on fertilized soils. Fertilized plots had significantly more available soil NO_3-N than compost treated plots on several

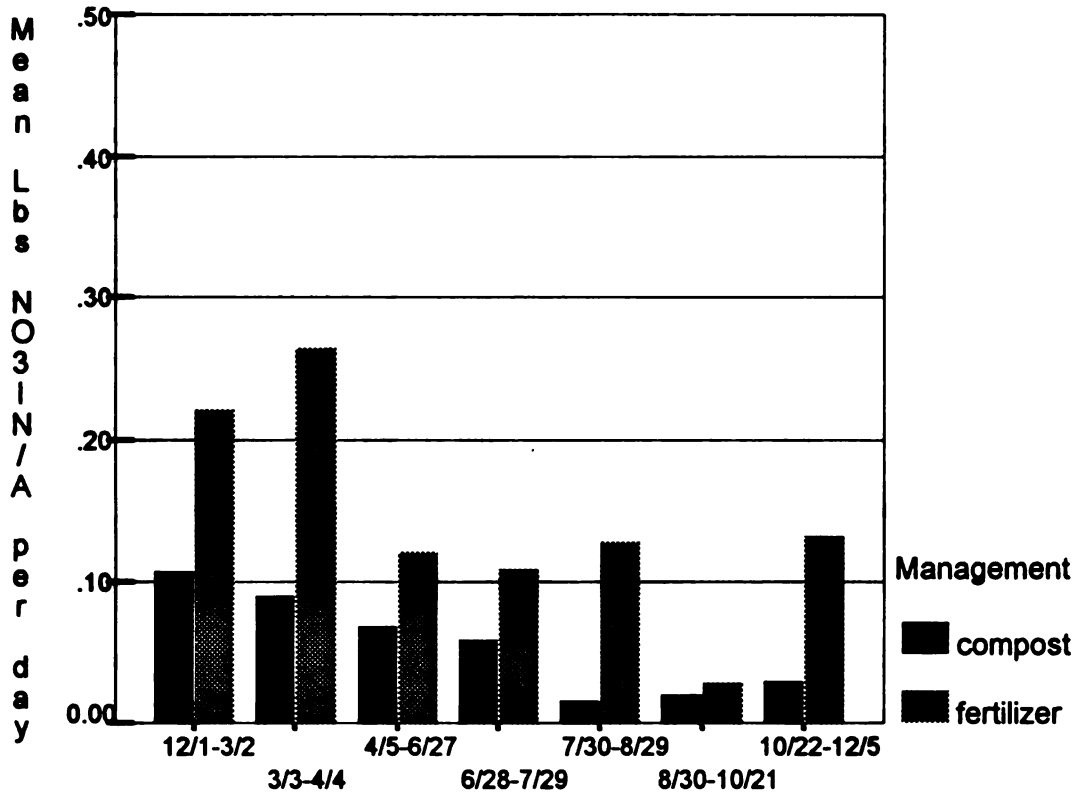

Figure 6. 1994 lysimeter NO3-N as a daily mean per time period.

dates, and the fertilized plots seem to have more available soil NO_3-N in general. Corn yields on compost treated soils were not comparable to fertilized corn yields, except for first year corn in 1994. The no cover crop treatment had significantly more available soil NO_3-N than the cover crop treatment on a few dates. This suggests that annual ryegrass or other N scavengers are not necessarily useful, at least in these initial years of compost use when N may be limiting.

The compost results of this experiment are those of the initial two years of compost use. Compost may be a good alternative to conventional fertilizer in soybean, wheat, and perhaps for corn not followed by corn, with or without cover crops, but not necessarily a good alternative for corn followed by corn. In the second year of compost use, after a good red clover crop in wheat, 1st year corn had average yields, but future results are needed to see how another year of corn will do. The hypothesized benefits from compost of adequate NO_3-N availability, less NO_3-N leaching, and comparable yields are not yet apparent, but may materialize in the subsequent years of the experiment. After several more years of compost use, wherein compost improves soil structure because of added organic matter, compost treated corn may do as well as fertilized corn. Ideally, crop yields will be maintained at high levels with less leaching losses.

Compost treated plots compared to fertilized plots had less available soil NO_3-N, similar NO_3-N leaching losses, and similar yields and biomass N in wheat and soybean but lower yields and biomass N in corn. Cover crops as compared to no cover crops had similar or less available soil NO_3-N and similar yields and biomass N. From this research it does appear that soybean and wheat yields can be maintained and NO_3-N leaching

decreased with compost, but the results of compost on corn followed by corn are less favorable. Further research is needed to establish whether or not compost has other benefits besides reducing NO_3-N leaching losses. More data are needed to see if compost does maintain soybean and wheat yields in subsequent years, as well as if corn following corn can be grown with compost alone.

APPENDICES

APPENDIX A: Soil Types

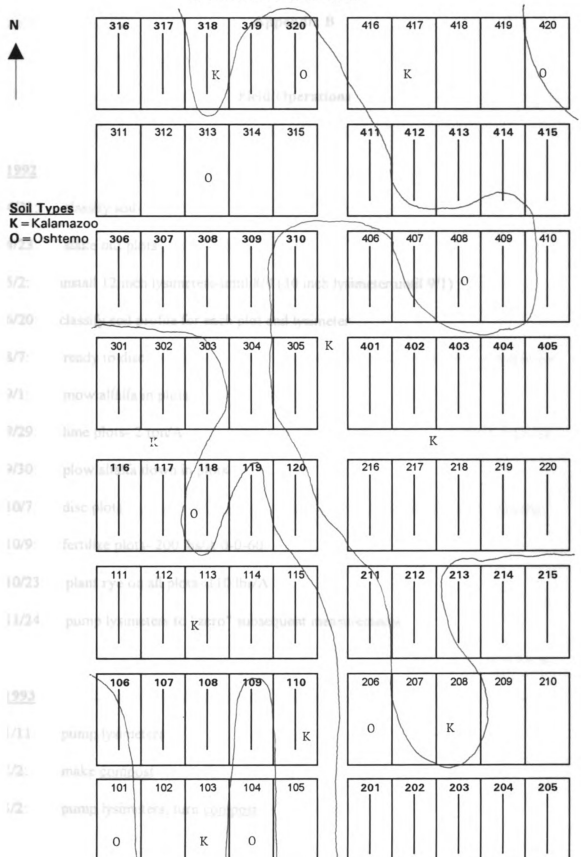

Figure A.1. Living Field Laboratory soil types.

Appendix B

Field Operations

1992

4/21: classify soil

4/23: stake out plots

5/2: install 12 inch lysimeters-until 8/4 (30 inch lysimeter until 9/1)

6/20: classify soil profile for each plot and lysimeter

8/7: ready to disc

9/1: mow alfalfa in plots

9/29: lime plots- 2 ton/A

9/30: plow alfalfa down in plots

10/7: disc plots

10/9: fertilize plots- 200 lbs/A 0-0-60

10/23: plant rye on all plots- 110 lbs/A

11/24: pump lysimeters to "zero" subsequent measurements

1993

1/11: pump lysimeters

2/2: make compost

3/2: pump lysimeters; turn compost

Field Op. (cont'd)

3/30: turn compost

4/12: pump lysimeters

4/14: sample soil- 3 foot depth, plots not split for cover crop

4/22: spread compost- 7580 lbs/A

4/23: chisel plow- all plots

4/25: disc plots twice; cultimulch plots

4/26: plant **wheat**- 150 lbs/A Butte 86 Spring wheat

4/27: fertilize **wheat**- 150 lbs/A 46-0-0 (70 lbs N actual)

5/6: field cultivate-all plots but wheat; sample soil- 1 foot depth, plots not split for cover crop

5/7: plant **corn**- 25,680 seed/A Pioneer 3751; fertilize **corn** - 200 lbs/A 6-24-24 (12 lbs N actual)

5/8: spray fertilizer and compost **corn** plots- 10 inch band of 0.75 qt/A Atrazine, 1.5 qt/A Bladex , 2 qt/A Lasso

5/12: plant **soybeans**- 50 lbs/A BSR 101

5/13: plant red **clover** in wheat- 15 lbs/A

5/14: band spray fertilizer and compost **soybeans**- 0.6 pts/A Sencor, 2 qts/A Lasso

5/19: sample soil-1 foot depth, wheat plots split for cover crop

5/20: disc plots

5/26 sample soil- 1 foot depth, wheat plots split for cover crop

6/3: sample soil- 1 foot depth, wheat plots split for cover crop

Field Op. (cont'd)

10/18: spread compost on **wheat** plots- 65,880 lbs/A

10/24: pick corn; cultimulch corn plots; fertilize **wheat** plots- 60 lbs/A actual 0-46-0, 130 lbs/A actual 0-0-60; plant **wheat**- 2.5 bu/A Augusta

10/26: pump lysimeters

10/27: sample soil- 3 foot depth, all plots split for cover crop

11/30: pump lysimeters

1994

3/2: pump lysimeters

3/17: fertilize **wheat** -175 lbs/A 46-0-0 (80 lbs N actual); plant red **clover** in wheat- 14 lbs/A Michigan mammoth

4/4: pump lysimeters

4/11: sample soil- 3 foot depth, all plots split for cover crop

4/20: mow corn stalks

4/21: spread compost on **corn** plots- 75,290 lbs/A

4/25: chisel corn and soybean plots

4/27: disc corn and soybean plots

5/3: work up corn plots; fertilize **corn**- 225 lbs/A actual 0-0-60

5/4: plant **corn**- 25,700 seeds/A Pioneer 3751; fertilize **corn**- 110 lbs/A 5-20-20 (5 lbs N actual); sample soil-1 foot depth, all plots split for cover crop

5/13: spray **corn**- band; fertilize **soybeans**- 120 lbs/A actual 0-0-60

Field Op. (cont'd)

5/17: spray all **wheat**- 3/8 pint/A MCPA; field cultivated soybean plots; plant **soybeans**- 50 lbs/A BSR 101, no inoculum

5/18: sample soil-1 foot depth, all plots split for cover crop

5/23: spray **soybeans**- banded Sencor and Dual

5/25: rotory hoe corn and soybean plots

6/1: cultivate all corn

6/7: irrigate west half of LFL- 2 inches

6/8: irrigate east half of LFL- 2 inches

6/10: sample soil-1 foot depth, all plots split for cover crop

6/16: cultivate all soybeans; sidedress **corn** fertilizer plots- 75 lbs N actual

6/17: plant cover crops- red **clover** 15 lbs/A, annual **ryegrass** 25 lbs/A

6/22: cultivate soybeans

6/29: pump lysimeters

7/11: sample soil-1 foot depth, all plots split for cover crop

7/12: **wheat** biomass- 2 square yards

7/18: harvest **wheat**- 49 inches by 50 feet

7/29: pump lysimeters

8/24: red **clover** (in wheat) biomass- 10.75 by 10.75 inches

8/25: mow wheat plots

8/29: pump lysimeters

8/30: spray for Japanese beetle- Sevin 80wp

Field Op. (cont'd)

9/7: **soybean** biomass- 5 foot of row

9/26: **corn** biomass- 10 random stalks

9/30: harvest **soybeans**- 2 rows by 50 feet

10/3: **sample** soil-1 foot depth, all plots split for cover crop

10/4: fertilize **wheat** plots-110 lbs/A 0-0-60, 160 lbs/A 19-19-19 (30 lbs N actual); spread compost on **wheat**- 67,650 lbs/A; chisel wheat plots

10/5: hand harvest **corn**- 2 rows by 20 feet; cultimulch wheat plots; plant **wheat**- 130 lbs/A

10/12: corn **cover crop** biomass- 10.75 by 10.75 inches

11/3: clean corn plots

11/8: sample soil- 3 foot depth, all plots split for cover crop

12/5: pump lysimeters

Appendix C

Weather Data

Table C.1. Rainfall amounts between lysimeter pumpings.

DATE	INCHES	DAYS	IN. PER DAY
1993			
Nov. 25- Jan. 11	4.43	48	0.09
Jan. 12- Mar. 2	1.08	50	0.02
Mar. 3- Apr. 12	2.52	41	0.06
Apr. 13- June 10	6.46	59	0.11
June 11- July 6	4.56	26	0.18
July 7- Sept. 22	9.39	77	0.12
Sept. 23- Oct. 26	4.84	34	0.14
Oct. 27- Nov. 30	0.75	35	0.02
1994			
Dec. 1- Mar. 2	1.83	92	0.02
Mar. 3- Apr. 4	1.50	33	0.05
Apr. 5- June 27	12.01	83	0.14 [1]
June 28- July 29	6.59	32	0.21
July 30- Aug. 29	6.13	31	0.20
Aug. 30- Oct. 21	2.84	53	0.05
Oct. 22- Dec. 5	5.88	45	0.13

[1] includes 2 inches irrigation

Appendix D

Statistical Analysis

Table D.1. Anova for a split block design used for yield analysis of crops with management type as main plot and cover crop as sub plot. (syntax = rep vs 2 mgmnt vs 2 mgmnt*rep = 2 cov vs 1 cov*rep = 1 cov*mgmnt.)

1994 Soybean example:

Source of Variation	DF	SS	MS	F	Sig. of F
		--------bu/A--------			
Residual	3	251.36	83.79		
Cover* Management	1	22.28	22.28	0.27	0.64
Error 1	3	54.65	18.22		
Cover	1	75.34	75.34	4.14	0.14
Error 2	3	976.30	325.43		
Rep	3	286.18	95.39	0.29	0.83
Management	1	267.65	267.65	0.82	0.43

Table D.2. Anova for a split block design used for biomass N analysis of crops with management type as main plot and cover crop as sub plot. (syntax = rep vs 2 mgmnt vs 2 mgmnt*rep = 2 cov vs 1 cov*rep = 1 cov*mgmnt.)

1994 Soybean example:

Source of Variation	DF	SS	MS	F	Sig. of F
		--------lbs N/A-------			
Residual	3	4980.08	1660.03		
Cover* Management	1	683.95	683.95	0.41	0.57
Error 1	3	1863.84	621.28		
Cover	1	1193.18	1193.18	1.92	0.26
Error 2	3	1153.61	384.54		
Rep	3	6872.71	2290.90	5.96	0.09
Management	1	10.58	10.58	0.03	0.88

Table D.3. Anova for a randomized complete block design used for biomass N analysis of cover crops. (syntax = rep mgmnt.)

1994 Red clover in wheat example:

Source of Variation	DF	SS	MS	F	Sig. of F
		--------lbs N/A-------			
Residual	3	978.96	326.32		
Rep	3	1147.65	382.55	1.17	0.45
Management	1	3669.67	3669.67	11.25	0.04

Table D.4. Anova for a split block within a split plot design used for soil analysis with management type as main plot, crop as sub plot, and cover crop as sub-sub plot on each date. (syntax = rep vs 3 mgmnt vs 3 mgmnt*rep = 3 crop vs 2 crop*mgmnt vs 2 crop*rep + crop*mgmnt*rep = 2 cover vs 1 cover*rep = 1 cover*mgmnt.)

1994 April 11 example:

Source of Variation	DF	SS	MS	F	Sig. of F
		-------ppm-------			
Residual	35	225.06	6.43		
Cover*Management	1	13.71	13.71	2.13	0.15
Error 1	3	36.23	12.08		
Cover	1	51.36	51.36	4.25	0.13
Error 2	24	137.53	5.73		
Crop	4	67.23	16.81	2.93	0.04
Crop* Management	4	24.85	6.21	1.08	0.39
Error 3	3	32.59	10.86		
Rep	3	31.85	10.62	0.98	0.51
Management	1	77.78	77.78	7.16	0.08

Table D.5. Anova for a split block design used for soil analysis with management type as main plot and cover crop as sub plot for each crop on each date. (syntax = rep vs 2 mgmnt vs 2 mgmnt*rep = 2 cover vs 1 cover*rep = 1 cover*mgmnt.)

1994 April 11 Soybean example:

Source of Variation	DF	SS	MS	F	Sig. of F
		-------ppm-------			
Residual	3	0.96	0.32		
Cover*Management	1	2.67	2.67	8.37	0.06
Error 1	3	6.96	2.32		
Cover	1	2.68	2.68	1.16	0.36
Error 2	3	3.91	1.30		
Rep	3	7.41	2.47	1.90	0.31
Management	1	8.72	8.72	6.70	0.08

Table D.6. Anova for a split plot design used for lysimeter analysis on each date with management type as main plot and crop as sub plot. (syntax = rep vs 1 mgmnt vs 1 mgmnt*rep = 1 crop crop*mgmnt.)

1994 March 2 example:

Source of Variation	DF	SS	MS	F	Sig. of F
		-------lbs NO_3-N/A-------			
Residual	24	7274.74	303.11		
Crop	4	1510.62	377.65	1.25	0.32
Crop* Management	4	897.58	224.40	0.74	0.57
Error 1	3	166.68	55.56		
Rep	3	735.93	245.31	4.42	0.13
Management	1	1093.70	1093.70	19.69	0.02

Table D.7. Anova for a randomized complete block design used for lysimeter analysis of each crop on each date. (syntax = rep mgmnt.)

1994 March 2 Soybean example:

Source of Variation	DF	SS	MS	F	Sig. of F
		-------lbs NO_3-N/A-------			
Residual	3	223.27	74.42		
Rep	3	96.64	32.21	0.43	0.75
Management	1	671.43	671.43	9.02	0.06

Appendix E

Yield and Biomass N

Table E.1. Crop yield comparing compost and fertilizer treatments with and without cover crop in 1993.

TREATMENT	COVER	PLOT REP 1	REP 2	REP 3	REP 4	MEAN	CROP MEAN
		bu/acre					
COMPOST							
soybean	cover[1]	54	45	58	45	50 [2]	
soybean	no cover	54	45	58	45	50	50
wheat	clover	20	25	22	27	23 [2]	
wheat	no cover	20	25	22	27	23	23
1st year corn	rygr/vetch	134	120	146	123	131	
1st year corn	no cover	142	131	125	136	134	132
2nd year corn	ryegrass	129	112	144	137	131	
2nd year corn	no cover	121	128	123	140	128	129
continuous corn	rygr/vetch	150	105	140	132	132	
continuous corn	no cover	119	70	155	134	120	126
corn rep mean		132	111	139	134	129	
FERTILIZER							
soybean	cover[1]	46	43	51	41	45 [2]	
soybean	no cover	46	43	51	41	45	45
wheat	clover	19	15	19	19	18 [2]	
wheat	no cover	19	15	19	19	18	18
1st year corn	rygr/vetch	162	163	162	141	157	
1st year corn	no cover	168	159	148	154	157	157
2nd year corn	ryegrass	147	172	136	169	156	
2nd year corn	no cover	179	176	162	146	166	161
continuous corn	rygr/vetch	154	158	135	164	153	
continuous corn	no cover	192	138	152	148	158	155
corn rep mean		167	161	149	154	158	
soybean rep mean		50	44	54	43	48	
wheat rep mean		20	20	20	23	21	
corn rep mean		150	136	144	144	143	

[1]soybean has no cover crop present, but designation shows plot history

[2]plots not split for cover crop

Table E.2. Crop yield comparing compost and fertilizer treatments with and without cover crop in 1994.

TREATMENT	COVER	PLOT REP 1	REP 2	REP 3	REP 4	MEAN	CROP MEAN
		bu/acre					
COMPOST							
soybean	cover[1]	47	50	54	22	43	
soybean	no cover	53	52	49	47	50	47
wheat	clover	48	46	49	42	46	
wheat	no cover	58	45	47	44	48	47
1st year corn	rygr/clover	185	189	184	190	187	
1st year corn	no cover	181	219	166	176	186	186
2nd year corn	ryegrass	111	94	111	115	108	
2nd year corn	no cover	147	98	119	145	127	117
continuous corn	rygr/clover	129	121	120	131	125	
continuous corn	no cover	129	122	114	107	118	122
corn rep mean		147	141	136	144	142	
FERTILIZER							
soybean	cover[1]	41	21	39	50	38	
soybean	no cover	40	22	49	47	40	39
wheat	clover	49	47	49	41	47	
wheat	no cover	48	48	44	47	47	47
1st year corn	rygr/clover	184	202	198	182	191	
1st year corn	no cover	184	168	192	193	185	188
2nd year corn	ryegrass	156	158	145	168	157	
2nd year corn	no cover	177	184	170	182	178	167
continuous corn	rygr/clover	162	95	171	136	141	
continuous corn	no cover	138	97	168	146	137	139
corn rep mean		167	151	174	168	165	
soybean rep mean		45	37	48	41	43	
wheat rep mean		51	47	47	43	47	
corn rep mean		157	146	155	156	153	

[1]soybean has no cover crop present, but designation shows plot history

Table E.3. Crop total above-ground biomass dry weight comparing compost and fertilizer treatments with and without cover crop in 1993.

TREATMENT	COVER	PLOT REP 1	REP 2	REP 3	REP 4	MEAN	CROP MEAN
		lbs biomass/acre					
COMPOST							
soybean	cover[1]	4390	5230	4650	3800	4520 [2]	
soybean	no cover	4390	5230	4650	3800	4520	4520
wheat	clover	2120	2080	2510	1870	2150	
wheat	no cover	1860	1340	2710	2750	2170	2160
1st year corn	rygr/vetch	7960	5470	7910	5510	6710	
1st year corn	no cover	5950	6740	6550	7760	6750	6730
2nd year corn	ryegrass	7020	6420	6980	8320	7190	
2nd year corn	no cover	6790	7410	5900	9000	7280	7240
continuous corn	rygr/vetch	7470	6890	8500	5590	7110	
continuous corn	no cover	6850	5780	5830	8430	6720	6920
corn rep mean		7010	6450	6950	7440	6960	
FERTILIZER							
soybean	cover[1]	4160	3090	4080	4720	4010 [2]	
soybean	no cover	4160	3090	4080	4720	4010	4010
wheat	clover	2120	1830	1530	1430	1730	
wheat	no cover	1660	1410	2800	3300	2290	2010
1st year corn	rygr/vetch	10570	8510	6950	7030	8270	
1st year corn	no cover	10700	10540	8490	8020	9440	8860
2nd year corn	ryegrass	8360	4830	7980	7310	7120	
2nd year corn	no cover	8700	7940	8200	8790	8410	7770
continuous corn	rygr/vetch	8510	7750	5650	6250	7040	
continuous corn	no cover	10500	9330	7750	9160	9190	8120
corn rep mean		9560	8150	7500	7760	8240	
soybean rep mean		4280	4160	4370	4260	4270	
wheat rep mean		1940	1670	2390	2340	2090	
corn rep mean		8280	7300	7220	7600	7600	

[1] soybean has no cover crop present, but designation shows plot history

[2] plots not split for cover crop

Table E.4. Cover crop total above-ground biomass dry weight comparing compost and fertilizer treatments in 1993.

		PLOT				
TREATMENT	**CROP**	**REP 1**	**REP 2**	**REP 3**	**REP 4**	**MEAN**
		----------lbs biomass/acre----------				
COMPOST						
red clover	wheat	1590	730	1180	1180	1170
a.rygr/r.clover	1st yr corn	420	120	460	180	300
annual ryegrass	2nd yr cor	300	340	270	360	320
a.rygr/r.clover	cont corn	240	490	410	270	350
FERTILIZER						
red clover	wheat	1950	980	910	890	1180
a.rygr/r.clover	1st yr corn	430	390	350	320	370
annual ryegrass	2nd yr cor	530	860	620	310	580
a.rygr/r.clover	cont corn	690	440	400	340	470
rep means		770	540	580	480	590

Table E.5. Crop total above-ground biomass percent N comparing compost and fertilizer treatments with and without cover crop in 1993.

		PLOT											
		REP 1			REP 2			REP 3			REP 4		
TREATMENT	COVER	Stover	Grain	Total	Stover	Grain	Total	Stover	Grain	Total	Stover	Grain	Total[1]
		%N											
COMPOST													
soybean	cover[2]	0.7	5.7		0.7	8.4		0.7	8.4		0.7	7.9[3]	
soybean	no cover	0.7	5.7		0.7	8.4		0.7	8.4		0.7	7.9	
wheat	clover			1.7			1.4			1.8			1.6
wheat	no cover			1.4			1.5			1.4			1.4
1st year corn	rygr/vetch	0.9	1.1		0.6	0.9		1.0	1.4		0.8	1.3	
1st year corn	no cover	1.1	1.2		0.7	0.9		1.0	1.1		0.8	1.2	
2nd year corn	ryegrass	0.9	1.1		0.8	1.3		0.9	1.3		0.8	1.2	
2nd year corn	no cover	1.1	1.1		0.8	1.2		0.8	1.1		0.9	1.2	
continuous corn	rygr/vetch	1.0	1.2		1.0	0.9		0.8	1.2		0.9	1.2	
continuous corn	no cover	1.0	1.2		0.8	1.2		0.7	1.2		1.0	1.2	
FERTILIZER													
soybean	cover[2]	0.8	4.8		0.5	8.9		0.6	8.0		0.6	8.3[3]	
soybean	no cover	0.8	4.8		0.5	8.9		0.6	8.0		0.6	8.3	
wheat	clover			2.0			2.0			1.8			2.0
wheat	no cover			1.9			1.8			1.8			1.8
1st year corn	rygr/vetch	1.3	1.5		1.0	1.4		1.3	1.6		1.3	1.6	
1st year corn	no cover	1.6	1.3		1.0	1.4		1.3	1.5		1.2	1.6	
2nd year corn	ryegrass	1.1	1.5		1.2	1.4		1.2	1.5		1.2	1.5	
2nd year corn	no cover	1.3	1.4		1.1	1.4		1.3	1.5			1.5	
continuous corn	rygr/vetch	1.3	1.5		1.2	1.4		1.3	1.5		1.1	1.4	
continuous corn	no cover	1.4	1.5		1.2	1.4		1.3	1.5		1.2	1.5	

[1] "Total" means stover + grain, [2] soybean has no cover crop present, but designation shows plot history

[3] plots not split for cover crop

Table E.6. Cover crop total above-ground biomass percent N comparing compost and fertilizer treatments in 1993.

		PLOT				
TREATMENT	CROP	REP 1	REP 2	REP 3	REP 4	MEAN
		%N				
COMPOST						
red clover	wheat	2.1	2.2	2.1	2.3	2.1
a.rygr/h.vetch	1st yr corn	1.0	1.5	1.2	1.2	1.2
annual ryegrass	2nd yr cor	1.3	1.5	1.6	1.3	1.4
a.rygr/h.vetch	cont corn	1.8	1.1	1.5	1.5	1.5
FERTILIZER						
red clover	wheat	2.2	1.9	2.8	2.6	2.4
a.rygr/h.vetch	1st yr corn	1.7	1.8	1.3	1.5	1.6
annual ryegrass	2nd yr cor	0.9	2.2	1.2	1.8	1.5
a.rygr/h.vetch	cont corn	1.4	1.8	1.6	1.5	1.6

Table E.7. Crop total above-ground biomass N comparing compost and fertilizer treatments with and without cover crop in 1993.

TREATMENT	COVER	PLOT REP 1	REP 2	REP 3	REP 4	MEAN	CROP MEAN
		lbs N/acre					
COMPOST							
soybean	cover[1]	136	237	220	173	191 [2]	
soybean	no cover	136	237	220	173	191	191
wheat	clover	37	30	44	29	35	
wheat	no cover	26	21	39	39	31	33
1st year corn	rygr/vetch	76	36	83	49	61	
1st year corn	no cover	66	52	64	65	62	61
2nd year corn	ryegrass	65	56	68	72	65	
2nd year corn	no cover	74	61	50	86	68	66
continuous corn	rygr/vetch	79	66	72	51	67	
continuous corn	no cover	72	49	43	90	63	65
corn rep mean		72	53	63	69	64	
FERTILIZER							
soybean	cover[1]	115	159	187	213	169 [2]	
soybean	no cover	115	159	187	213	169	169
wheat	clover	42	36	28	29	34	
wheat	no cover	31	25	51	59	41	38
1st year corn	rygr/vetch	138	87	94	92	103	
1st year corn	no cover	166	105	116	101	122	112
2nd year corn	ryegrass	93	60	95	90	85	
2nd year corn	no cover	117	91	110	16	84	84
continuous corn	rygr/vetch	113	97	77	72	90	
continuous corn	no cover	152	116	103	114	121	105
corn rep mean		130	93	99	81	101	
soybean rep mean		125	198	204	193	180	
wheat rep mean		34	28	40	39	35	
corn rep mean		101	73	81	75	82	

[1] soybean has no cover crop present, but designation shows plot history

[2] plots not split for cover crop

Table E.8. Cover crop total above-ground biomass N comparing compost and fertilizer treatments in 1993.

		PLOT				
TREATMENT	CROP	REP 1	REP 2	REP 3	REP 4	MEAN
		----------lbs N/acre----------				
COMPOST						
red clover	wheat	34	16	25	27	25
a.rygr/h.vetch	1st yr corn	4	2	5	2	3
annual ryegrass	2nd yr cor	4	5	4	5	5
a.rygr/h.vetch	cont corn	4	6	6	4	5
rep means		12	7	10	10	9
FERTILIZER						
red clover	wheat	43	19	26	23	28
a.rygr/h.vetch	1st yr corn	7	7	5	5	6
annual ryegrass	2nd yr cor	5	19	8	5	9
a.rygr/h.vetch	cont corn	10	8	6	5	7
rep means		16	13	11	10	12
rep means		14	10	11	10	11

Table E.9. Crop total above-ground biomass dry weight comparing fertilizer and compost treatments with and without cover crop in 1994.

TREATMENT	COVER	PLOT REP 1	REP 2	REP 3	REP 4	MEAN	CROP MEAN
		lbs biomass/acre					
COMPOST							
soybean	cover[1]	4610	4630	5020	2330	4150	
soybean	no cover	4430	3680	4580	4350	4260	4210
wheat	clover	3590	3250	5000	2540	3600	
wheat	no cover	5210	3160	4230	2650	3810	3710
1st year corn	rygr/clover	18380	19170	19790	14140	17870	
1st year corn	no cover	15440	23170	16640	18660	18480	18180
2nd year corn	ryegrass	7390	8290	9750	11540	9240	
2nd year corn	no cover	14740	9690	12710	11620	12190	10820
continuous corn	rygr/clover	14240	11750	10580	8580	11290	
continuous corn	no cover	13790	13630	14170	12950	13640	12470
corn rep mean		14000	14280	13940	12920	13790	
FERTILIZER							
soybean	cover[1]	4230	2800	3620	4040	3670	
soybean	no cover	5370	3460	6080	3680	4650	4160
wheat	clover	4380	5610	3930	5140	4770	
wheat	no cover	4340	5140	3390	4580	4360	4570
1st year corn	rygr/clover	18860	17030	20940	14910	17940	
1st year corn	no cover	18750	15810	15710	16760	16760	17350
2nd year corn	ryegrass	16700	18470	19370	17460	18000	
2nd year corn	no cover	19460	19290	18900	16930	18650	18330
continuous corn	rygr/clover	17420	8310	16930	9750	13100	
continuous corn	no cover	12800	7580	18560	15110	13510	13310
corn rep mean		17330	14420	18400	15150	16330	
soybean rep mean		4660	3640	4830	3600	4180	
wheat rep mean		4380	4290	4140	3730	4140	
corn rep mean		15670	14350	16170	14030	15060	

[1] soybean has no cover crop present, but designation shows plot history

Table E.10. Cover crop total above-ground biomass dry weight comparing compost and fertilizer treatments in 1994.

		PLOT				
TREATMENT	CROP	REP 1	REP 2	REP 3	REP 4	MEAN
		----------lbs biomass/acre----------				
COMPOST						
red clover	wheat	2000	1200	2790	2580	2000
a.rygr/r.clover	1st yr corn	600	960	830	900	820
annual ryegrass	2nd yr cor	740	690	680	260	590
a.rygr/r.clover	cont corn	780	600	890	760	760
FERTILIZER						
red clover	wheat	1030	970	1070	1060	1030
a.rygr/r.clover	1st yr corn	380	610	650	840	620
annual ryegrass	2nd yr cor	1130	1410	900	440	970
a.rygr/r.clover	cont corn	660	980	1200	900	940
rep means		920	930	1130	970	970

Table E.11. Crop total above-ground biomass percent N comparing compost and fertilizer treatments with and without cover crop in 1994.

		PLOT											
		REP 1			REP 2			REP 3			REP 4		
TREATMENT	COVER	Stover	Grain	Total	Stover	Grain	Total	Stover	Grain	Total	Stover	Grain	Total[1]
		%N											
COMPOST													
soybean	cover[2]	0.7	5.7		0.7	8.4		0.7	8.4		0.7	7.9[3]	
soybean	no cover	0.7	5.7		0.7	8.4		0.7	8.4		0.7	7.9	
wheat	clover			1.4			1.2			1.1			1.1
wheat	no cover			1.0			1.2			0.8			1.1
1st year corn	rygr/clove	0.6	1.4		0.9	1.3		0.7	1.5		0.7	1.6	
1st year corn	no cover	0.6	1.2		0.8	1.4		0.7	1.4		0.5	1.4	
2nd year corn	ryegrass	1.4	6.9		1.1	6.1		1.7	6.5		2.5	6.4	
2nd year corn	no cover	1.2	6.5		1.9	6.7		1.6	6.7		1.4	6.3	
continuous corn	rygr/clove	0.6	1.1		0.5	1.2		0.6	1.2		0.5	1.0	
continuous corn	no cover	0.6	1.0		0.6	1.1		0.6	1.2		0.5	1.1	
FERTILIZER													
soybean	cover[2]	0.8	4.8		0.5	8.9		0.6	8.0		0.6	8.3[3]	
soybean	no cover	0.8	4.8		0.5	8.9		0.6	8.0		0.6	8.3	
wheat	clover			1.4			1.5			1.0			1.3
wheat	no cover			1.6			1.5			1.2			1.3
1st year corn	rygr/clove	0.8	1.5		0.7	1.5		1.0	1.6		1.0	1.5	
1st year corn	no cover	1.1	1.6		0.7	1.4		0.9	1.5		0.9	1.5	
2nd year corn	ryegrass	1.9	6.8		2.0	6.8		2.0	6.4		1.0	6.4	
2nd year corn	no cover	1.3	6.8		1.5	6.3		1.2	6.8		1.2	6.2	
continuous corn	rygr/clove	0.6	1.6		0.5	1.0		0.8	1.5		0.6	1.2	
continuous corn	no cover	0.6	1.4		0.4	1.1		0.9	1.5		0.7	1.6	

[1] "Total" means stover + grain, [2] soybean has no cover crop present, but designation shows plot history

[3] plots not split for cover crop

Table E.12. Cover crop total above-ground biomass percent N comparing compost and fertilizer treatments in 1994.

		PLOT				
TREATMENT	CROP	REP 1	REP 2	REP 3	REP 4	MEAN
		----------%N----------				
COMPOST						
red clover	wheat	3.6	3.3	3.6	2.7	3.5
a.rygr/ r.clover	1st yr corn	2.8	3.1	2.5	1.7	2.5
annual ryegrass	2nd yr cor	1.9	1.6	2.3	2.7	2.1
a.rygr/ r.clover	cont corn	2.6	3.5	3.2	3.1	3.1
FERTILIZER						
red clover	wheat	1.5	3.2	3.2	3.0	2.7
a.rygr/ r.clover	1st yr corn	2.8	1.9	2.8	2.7	2.5
annual ryegrass	2nd yr cor	1.8	2.5	1.7	2.5	2.1
a.rygr/ r.clover	cont corn	2.4	3.3	3.7	2.2	2.9

Table E.13. Crop total above-ground biomass N comparing compost and fertilizer treatments with and without cover crop in 1994.

		PLOT					CROP
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN	MEAN
		lbs N/acre					
COMPOST							
soybean	cover[1]	154	140	165	74	133	
soybean	no cover	136	113	150	150	137	135
wheat	clover	49	40	56	27	43	
wheat	no cover	50	36	34	30	38	40
1st year corn	rygr/clover	203	211	227	174	204	
1st year corn	no cover	147	266	194	197	201	203
2nd year corn	ryegrass	60	60	77	101	75	
2nd year corn	no cover	169	69	111	104	113	94
continuous corn	rygr/clover	131	107	99	67	101	
continuous corn	no cover	116	119	137	113	121	111
corn rep mean		138	139	141	126	136	
FERTILIZER							
soybean	cover[1]	152	95	105	121	118	
soybean	no cover	175	102	204	114	149	134
wheat	clover	63	86	40	66	64	
wheat	no cover	70	76	41	61	62	63
1st year corn	rygr/clover	233	202	281	188	226	
1st year corn	no cover	250	187	199	211	211	219
2nd year corn	ryegrass	191	196	268	191	212	
2nd year corn	no cover	231	222	259	210	230	221
continuous corn	rygr/clover	210	62	204	92	142	
continuous corn	no cover	135	57	234	183	152	147
corn rep mean		203	145	233	178	190	
soybean rep mean		154	113	156	115	134	
wheat rep mean		100	89	103	76	92	
corn rep mean		155	129	176	140	150	

[1] soybean has no cover crop present, but designation shows plot history

Table E.14. Cover crop total above-ground biomass N comparing compost and fertilizer treatments in 1994.

		PLOT				
TREATMENT	CROP	REP 1	REP 2	REP 3	REP 4	MEAN
		lbs N/acre				
COMPOST						
red clover	wheat	72	40	101	69	71
a.rygr/ r.clover	1st yr corn	17	29	20	16	21
annual ryegrass	2nd yr cor	14	11	15	7	12
a.rygr/ r.clover	cont corn	21	21	28	24	23
FERTILIZER						
red clover	wheat	15	30	34	32	28
a.rygr/ r.clover	1st yr corn	11	11	18	22	16
annual ryegrass	2nd yr cor	20	35	16	11	20
a.rygr/ r.clover	cont corn	16	32	44	20	28
rep means		23	26	35	25	27

Appendix F

Soil Data

Table F.1. Soil NO_3-N concentrations comparing compost and fertilizer treatments with and without cover crop in 1993.

April 14, 1993		PLOT					CROP
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN	MEAN
		ppm					
COMPOST							
soybean	cover[1]	2.6	2.3	2.2	2.4	2.4 [2]	
soybean	no cover	2.6	2.3	2.2	2.4	2.4	2.4
wheat	clover	2.1	3.7	2.3	3.3	2.8 [2]	
wheat	no cover	2.1	3.7	2.3	3.3	2.8	2.8
1st year corn	rygr/vetch	4.0	5.5	2.2	1.7	3.3 [2]	
1st year corn	no cover	4.0	5.5	2.2	1.7	3.3	3.3
2nd year corn	ryegrass	2.2	2.1	1.4	1.6	1.8 [2]	
2nd year corn	no cover	2.2	2.1	1.4	1.6	1.8	1.8
continuous corn	rygr/vetch	3.4	3.2	1.9	3.1	2.9 [2]	
continuous corn	no cover	3.4	3.2	1.9	3.1	2.9	2.9
corn rep mean		3.2	3.6	1.8	2.1	2.7	
FERTILIZER							
soybean	cover[1]	2.1	2.8	1.3	1.7	2.0 [2]	
soybean	no cover	2.1	2.8	1.3	1.7	2.0	2.0
wheat	clover	3.2	6.4	1.4	2.5	3.4 [2]	
wheat	no cover	3.2	6.4	1.4	2.5	3.4	3.4
1st year corn	rygr/vetch	5.5	4.5	1.4	4.5	4.0 [2]	
1st year corn	no cover	5.5	4.5	1.4	4.5	4.0	4.0
2nd year corn	ryegrass	3.9	4.0	1.9	2.7	3.1 [2]	
2nd year corn	no cover	3.9	4.0	1.9	2.7	3.1	3.1
continuous corn	rygr/vetch	3.0	3.3	3.3	2.6	3.1 [2]	
continuous corn	no cover	3.0	3.3	3.3	2.6	3.1	3.1
corn rep mean		4.1	3.9	2.2	3.3	3.4	
soybean rep mean		2.3	2.6	1.8	2.1	2.2	
wheat rep mean		2.6	5.0	1.8	2.9	3.1	
corn rep mean		3.7	3.8	2.0	2.7	3.0	

Table F.1. (cont'd)

May 6, 1993		PLOT					CROP
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN	MEAN
		ppm					
COMPOST							
soybean	cover[1]	4.1	2.9	3.3	2.3	3.2 [2]	
soybean	no cover	4.1	2.9	3.3	2.3	3.2	3.2
wheat	clover	5.8	6.4	3.6	4.1	5.0 [2]	
wheat	no cover	5.8	6.4	3.6	4.1	5.0	5.0
1st year corn	rygr/vetch	5.2	6.5	5.8	3.3	5.2 [2]	
1st year corn	no cover	5.2	6.5	5.8	3.3	5.2	5.2
2nd year corn	ryegrass	2.7	4.4	3.5	3.2	3.4 [2]	
2nd year corn	no cover	2.7	4.4	3.5	3.2	3.4	3.4
continuous corn	rygr/vetch	5.0	3.8	4.1	3.5	4.1 [2]	
continuous corn	no cover	5.0	3.8	4.1	3.5	4.1	4.1
corn rep mean		4.3	4.9	4.5	3.3	4.2	
FERTILIZER							
soybean	cover[1]	6.1	5.1	2.6	5.7	4.8 [2]	
soybean	no cover	6.1	5.1	2.6	5.7	4.8	4.8
wheat	clover	9.2	15.3	5.2	4.4	8.5 [2]	
wheat	no cover	9.2	15.3	5.2	4.4	8.5	8.5
1st year corn	rygr/vetch	8.2	6.9	4.2	4.8	6.0 [2]	
1st year corn	no cover	8.2	6.9	4.2	4.8	6.0	6.0
2nd year corn	ryegrass	4.5	3.2	2.8	5.2	3.9 [2]	
2nd year corn	no cover	4.5	3.2	2.8	5.2	3.9	3.9
continuous corn	rygr/vetch	5.7	4.5	4.8	5.4	5.1 [2]	
continuous corn	no cover	5.7	4.5	4.8	5.4	5.1	5.1
corn rep mean		6.1	4.9	4.0	5.2	5.0	
soybean rep mean		5.1	4.0	2.9	4.0	4.0	
wheat rep mean		7.5	10.8	4.4	4.2	6.7	
corn rep mean		5.2	4.9	4.2	4.2	4.6	

Table F.1. (cont'd)

May 19, 1993		PLOT					CROP
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN	MEAN
		ppm					
COMPOST							
soybean	cover[1]	9.5	5.3	10.5	7.4	8.2 [2]	
soybean	no cover	9.5	5.3	10.5	7.4	8.2	8.2
wheat	clover	12.6	10.2	6.7	17.6	11.8	
wheat	no cover	10.0	7.6	10.0	8.3	9.0	10.4
1st year corn	rygr/vetch	11.7	9.4	12.2	7.0	10.1 [2]	
1st year corn	no cover	11.7	9.4	12.2	7.0	10.1	10.1
2nd year corn	ryegrass	6.1	6.1	6.6	8.2	6.8 [2]	
2nd year corn	no cover	6.1	6.1	6.6	8.2	6.8	6.8
continuous corn	rygr/vetch	12.0	8.3	7.3	8.0	8.9 [2]	
continuous corn	no cover	12.0	8.3	7.3	8.0	8.9	8.9
corn rep mean		9.9	7.9	8.7	7.7	8.6	
FERTILIZER							
soybean	cover[1]	11.2	9.9	5.8	5.6	8.1 [2]	
soybean	no cover	11.2	9.9	5.8	5.6	8.1	8.1
wheat	clover	19.1	26.6	15.4	10.9	18.0	
wheat	no cover	36.1	31.5	13.9	8.8	22.6	20.3
1st year corn	rygr/vetch	12.8	10.8	10.6	10.1	11.1 [2]	
1st year corn	no cover	12.8	10.8	10.6	10.1	11.1	11.1
2nd year corn	ryegrass	10.4	12.2	6.4	8.6	9.4 [2]	
2nd year corn	no cover	10.4	12.2	6.4	8.6	9.4	9.4
continuous corn	rygr/vetch	12.3	9.5	9.9	6.3	9.5 [2]	
continuous corn	no cover	12.3	9.5	9.9	6.3	9.5	9.5
corn rep mean		11.8	10.9	9.0	8.3	10.0	
soybean rep mean		10.4	7.6	8.1	6.5	8.1	
wheat rep mean		19.4	19.0	11.5	11.4	15.3	
corn rep mean		10.9	9.4	8.8	8.0	9.3	

Table F.1. (cont'd)

May 26, 1993		PLOT					CROP
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN	MEAN
		ppm					
COMPOST							
soybean	cover[1]	12.4	10.1	9.9	14.9	11.8 [2]	
soybean	no cover	12.4	10.1	9.9	14.9	11.8	11.8
wheat	clover	3.6	5.5	5.6	4.6	4.8	
wheat	no cover	5.8	4.6	5.3	6.1	5.5	5.1
1st year corn	rygr/vetch	11.3	11.0	7.5	11.9	10.4 [2]	
1st year corn	no cover	11.3	11.0	7.5	11.9	10.4	10.4
2nd year corn	ryegrass	13.9	11.5	16.0	11.9	13.3 [2]	
2nd year corn	no cover	13.9	11.5	16.0	11.9	13.3	13.3
continuous corn	rygr/vetch	19.3	16.2	7.7	9.8	13.3 [2]	
continuous corn	no cover	19.3	16.2	7.7	9.8	13.3	13.3
corn rep mean		14.9	12.9	10.4	11.2	12.3	
FERTILIZER							
soybean	cover[1]	9.2	10.1	6.8	12.7	9.7 [2]	
soybean	no cover	9.2	10.1	6.8	12.7	9.7	9.7
wheat	clover	7.5	24.4	16.2	8.6	14.2	
wheat	no cover	7.9	16.7	15.2	9.0	12.2	13.2
1st year corn	rygr/vetch	13.3	12.6	6.7	10.9	10.9 [2]	
1st year corn	no cover	13.3	12.6	6.7	10.9	10.9	10.9
2nd year corn	ryegrass	10.6	8.1	5.6	8.1	8.1 [2]	
2nd year corn	no cover	10.6	8.1	5.6	8.1	8.1	8.1
continuous corn	rygr/vetch	9.9	13.2	14.4	8.7	11.5 [2]	
continuous corn	no cover	9.9	13.2	14.4	8.7	11.5	11.5
corn rep mean		11.3	11.3	8.9	9.2	10.2	
soybean rep mean		10.8	10.1	8.4	13.8	10.8	
wheat rep mean		6.2	12.8	10.6	7.1	9.2	
corn rep mean		13.1	12.1	9.6	10.2	11.3	

Table F.1. (cont'd)

June 3, 1993		PLOT					CROP
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN	MEAN
		ppm					
COMPOST							
soybean	cover[1]	9.5	14.2	10.6	11.1	11.3 [2]	
soybean	no cover	9.5	14.2	10.6	11.1	11.3	11.3
wheat	clover	6.2	11.5	5.3	4.9	7.0	
wheat	no cover	7.5	11.2	6.2	4.7	7.4	7.2
1st year corn	rygr/vetch	11.2	9.6	14.2	6.6	10.4 [2]	
1st year corn	no cover	11.2	9.6	14.2	6.6	10.4	10.4
2nd year corn	ryegrass	12.0	7.7	8.7	17.1	11.4 [2]	
2nd year corn	no cover	12.0	7.7	8.7	17.1	11.4	11.4
continuous corn	rygr/vetch	13.5	7.6	7.4	9.7	9.5 [2]	
continuous corn	no cover	13.5	7.6	7.4	9.7	9.5	9.5
corn rep mean		12.2	8.3	10.1	11.1	10.4	
FERTILIZER							
soybean	cover[1]	8.3	8.3	6.6	13.7	9.2 [2]	
soybean	no cover	8.3	8.3	6.6	13.7	9.2	9.2
wheat	clover	14.8	13.1	8.5	14.0	12.6	
wheat	no cover	16.8	34.0	18.4	6.5	18.9	15.8
1st year corn	rygr/vetch	25.1	15.9	6.2	11.4	14.6 [2]	
1st year corn	no cover	25.1	15.9	6.2	11.4	14.6	14.6
2nd year corn	ryegrass	10.3	12.3	6.8	14.4	10.9 [2]	
2nd year corn	no cover	10.3	12.3	6.8	14.4	10.9	10.9
continuous corn	rygr/vetch	13.2	14.0	11.0	12.2	12.6 [2]	
continuous corn	no cover	13.2	14.0	11.0	12.2	12.6	12.6
corn rep mean		16.2	14.1	8.0	12.6	12.7	
soybean rep mean		8.9	11.3	8.6	12.4	10.3	
wheat rep mean		11.3	17.4	9.6	7.5	11.5	
corn rep mean		14.2	11.2	9.1	11.9	11.6	

Table F.1. (cont'd)

June 11, 1993		PLOT					CROP
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN	MEAN
		ppm					
COMPOST							
soybean	cover[1]	8.2	9.7	10.7	8.2	9.2 [2]	
soybean	no cover	8.2	9.7	10.7	8.2	9.2	9.2
wheat	clover	2.4	1.8	2.2	1.8	2.0	
wheat	no cover	2.2	2.2	2.0	2.5	2.2	2.1
1st year corn	rygr/vetch	10.7	9.1	10.3	8.5	9.6 [2]	
1st year corn	no cover	10.7	9.1	10.3	8.5	9.6	9.6
2nd year corn	ryegrass	8.7	9.8	9.8	9.1	9.3 [2]	
2nd year corn	no cover	8.7	9.8	9.8	9.1	9.3	9.3
continuous corn	rygr/vetch	13.8	8.5	10.5	9.2	10.5 [2]	
continuous corn	no cover	13.8	8.5	10.5	9.2	10.5	10.5
corn rep mean		11.1	9.1	10.2	9.0	9.8	
FERTILIZER							
soybean	cover[1]	8.0	11.3	6.8	11.0	9.3 [2]	
soybean	no cover	8.0	11.3	6.8	11.0	9.3	9.3
wheat	clover	16.0	16.9	8.3	15.4	14.1	
wheat	no cover	17.2	18.5	9.1	8.1	13.2	13.7
1st year corn	rygr/vetch	11.7	10.9	9.5	9.8	10.5 [2]	
1st year corn	no cover	11.7	10.9	9.5	9.8	10.5	10.5
2nd year corn	ryegrass	7.1	8.0	12.7	9.3	9.3 [2]	
2nd year corn	no cover	7.1	8.0	12.7	9.3	9.3	9.3
continuous corn	rygr/vetch	11.1	13.8	10.3	9.4	11.1 [2]	
continuous corn	no cover	11.1	13.8	10.3	9.4	11.1	11.1
corn rep mean		10.0	10.9	10.8	9.5	10.3	
soybean rep mean		8.1	10.5	8.7	9.6	9.2	
wheat rep mean		9.4	9.8	5.4	6.9	7.9	
corn rep mean		10.5	10.0	10.5	9.2	10.1	

Table F.1. (cont'd)

June 16, 1993		PLOT					CROP
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN	MEAN
		ppm					
COMPOST							
soybean	cover[1]	8.8	9.2	11.2	6.4	8.9 [2]	
soybean	no cover	8.8	9.2	11.2	6.4	8.9	8.9
wheat	clover	3.1	3.5	2.3	2.8	2.9	
wheat	no cover	1.5	2.8	2.6	1.3	2.1	2.5
1st year corn	rygr/vetch	14.9	7.9	13.9	6.2	10.7 [2]	
1st year corn	no cover	14.9	7.9	13.9	6.2	10.7	10.7
2nd year corn	ryegrass	10.9	10.3	16.6	7.7	11.4 [2]	
2nd year corn	no cover	10.9	10.3	16.6	7.7	11.4	11.4
continuous corn	rygr/vetch	14.2	11.4	6.8	11.2	10.9 [2]	
continuous corn	no cover	14.2	11.4	6.8	11.2	10.9	10.9
corn rep mean		13.3	9.9	12.4	8.4	11.0	
FERTILIZER							
soybean	cover[1]	10.4	8.3	9.1	8.0	9.0 [2]	
soybean	no cover	10.4	8.3	9.1	8.0	9.0	9.0
wheat	clover	9.5	14.1	7.6	12.3	10.9	
wheat	no cover	13.8	7.6	9.3	8.6	9.8	10.4
1st year corn	rygr/vetch	16.1	13.8	8.9	10.8	12.4 [2]	
1st year corn	no cover	16.1	13.8	8.9	10.8	12.4	12.4
2nd year corn	ryegrass	12.2	8.0	7.8	14.5	10.6 [2]	
2nd year corn	no cover	12.2	8.0	7.8	14.5	10.6	10.6
continuous corn	rygr/vetch	12.3	13.5	13.0	9.1	12.0 [2]	
continuous corn	no cover	12.3	13.5	13.0	9.1	12.0	12.0
corn rep mean		13.5	11.8	9.9	11.5	11.6	
soybean rep mean		9.6	8.8	10.2	7.2	8.9	
wheat rep mean		7.0	7.0	5.5	6.3	6.4	
corn rep mean		13.4	10.8	11.1	9.9	11.3	

Table F.1. (cont'd)

July 14, 1993		PLOT					CROP
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN	MEAN
		ppm					
COMPOST							
soybean	cover[1]	8.4	5.6	8.1	9.4	7.8 [2]	
soybean	no cover	8.4	5.6	8.1	9.4	7.8	7.8
wheat	clover	1.8	1.4	1.3	1.9	1.6	
wheat	no cover	0.8	2.8	1.6	1.6	1.7	1.6
1st year corn	rygr/vetch	3.2	2.6	7.7	2.3	3.9	
1st year corn	no cover	8.0	3.3	6.7	2.6	5.1	4.5
2nd year corn	ryegrass	3.7	2.7	3.2	4.2	3.5	
2nd year corn	no cover	4.3	4.5	3.9	5.8	4.6	4.0
continuous corn	rygr/vetch	5.2	3.0	2.3	2.6	3.3	
continuous corn	no cover	3.8	7.7	3.4	3.0	4.5	3.9
corn rep mean		4.7	4.0	4.5	3.4	4.1	
FERTILIZER							
soybean	cover[1]	5.2	9.5	6.6	9.7	7.8 [2]	
soybean	no cover	5.2	9.5	6.6	9.7	7.8	7.8
wheat	clover	3.8	2.3	2.4	3.1	2.9	
wheat	no cover	2.4	3.0	1.0		2.1	2.5
1st year corn	rygr/vetch	12.2	7.6	8.3	11.6	9.9	
1st year corn	no cover	10.4	9.8	9.2	10.9	10.1	10.0
2nd year corn	ryegrass	5.9	10.5	11.8	13.0	10.3	
2nd year corn	no cover	12.3	12.0	9.6	12.2	11.5	10.9
continuous corn	rygr/vetch	29.2	9.8	16.4	8.0	15.8	
continuous corn	no cover	8.2	12.0	10.0	6.7	9.2	12.5
corn rep mean		13.0	10.3	10.9	10.4	11.1	
soybean rep mean		6.8	7.5	7.3	9.5	7.8	
wheat rep mean		2.2	2.4	1.6	2.2	2.1	
corn rep mean		8.9	7.1	7.7	6.9	7.6	

Table F.1. (cont'd)

Aug. 17, 1993		PLOT					CROP
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN	MEAN
		ppm					
COMPOST							
soybean	cover[1]	4.0	2.6	1.8	3.5	3.0 [2]	
soybean	no cover	4.0	2.6	1.8	3.5	3.0	3.0
wheat	clover	2.4	2.6	2.3	2.6	2.5	
wheat	no cover	2.7	2.3	3.0	3.5	2.9	2.7
1st year corn	rygr/vetch	1.6	1.7	1.8	2.1	1.8	
1st year corn	no cover	1.9	2.7	1.6	2.7	2.2	2.0
2nd year corn	ryegrass	2.3	2.7	2.0	2.1	2.3	
2nd year corn	no cover	2.0	2.2	2.0	1.6	2.0	2.1
continuous corn	rygr/vetch	2.3	1.8	1.6	1.4	1.8	
continuous corn	no cover	2.0	2.1	1.9	2.1	2.0	1.9
corn rep mean		2.0	2.2	1.8	2.0	2.0	
FERTILIZER							
soybean	cover[1]	3.0	2.9	1.8	4.5	3.1 [2]	
soybean	no cover	3.0	2.9	1.8	4.5	3.1	3.1
wheat	clover	3.0	5.0	1.9	3.4	3.3	
wheat	no cover	7.3	3.9	2.2	6.5	5.0	4.2
1st year corn	rygr/vetch	4.3	3.3	3.0	7.2	4.4	
1st year corn	no cover	3.5	21.4	4.2	25.3	13.6	9.0
2nd year corn	ryegrass	2.8	7.7	2.3	5.2	4.5	
2nd year corn	no cover	3.0	4.8	3.2	4.8	4.0	4.2
continuous corn	rygr/vetch	4.0	11.6	3.2	3.7	5.6	
continuous corn	no cover	2.6	7.1	5.9	4.7	5.1	5.3
corn rep mean		3.4	9.3	3.6	8.5	6.2	
soybean rep mean		3.5	2.7	1.8	4.0	3.0	
wheat rep mean		3.9	3.4	2.4	4.0	3.4	
corn rep mean		2.7	5.8	2.7	5.2	4.1	

Table F.1. (cont'd)

Sept. 16, 1993		PLOT					CROP
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN	MEAN
		ppm					
COMPOST							
soybean	cover[1]	5.5	3.4	6.5	3.4	4.7 [2]	
soybean	no cover	5.5	3.4	6.5	3.4	4.7	4.7
wheat	clover	5.9	4.3	3.6	4.5	4.6	
wheat	no cover	5.0	5.7	6.7	4.4	5.5	5.0
1st year corn	rygr/vetch	4.1	3.7	5.0	3.1	4.0	
1st year corn	no cover	4.7	3.8	6.4	4.0	4.7	4.3
2nd year corn	ryegrass	4.6	3.8	4.1	3.9	4.1	
2nd year corn	no cover	4.2	3.7	5.5	3.4	4.2	4.1
continuous corn	rygr/vetch	4.2	4.3	6.6	2.9	4.5	
continuous corn	no cover	4.2	4.6	6.1	3.3	4.6	4.5
corn rep mean		4.3	4.0	5.6	3.4	4.3	
FERTILIZER							
soybean	cover[1]	5.4	7.4	4.6	7.6	6.3 [2]	
soybean	no cover	5.4	7.4	4.6	7.6	6.3	6.3
wheat	clover	6.5	7.8	3.3	6.2	6.0	
wheat	no cover	10.2	4.4	4.2	5.0	5.9	5.9
1st year corn	rygr/vetch	6.5	18.7	4.1	6.5	8.9	
1st year corn	no cover	7.3	7.6	5.8	8.5	7.3	8.1
2nd year corn	ryegrass	4.6	5.5	3.6	13.3	6.7	
2nd year corn	no cover	6.3	6.1	4.2	7.1	5.9	6.3
continuous corn	rygr/vetch	7.1	11.2	7.0	5.4	7.7	
continuous corn	no cover	4.6	6.2	10.5	9.1	7.6	7.6
corn rep mean		6.1	9.2	5.8	8.3	7.3	
soybean rep mean		5.4	5.4	5.5	5.5	5.5	
wheat rep mean		6.9	5.5	4.4	5.0	5.5	
corn rep mean		5.2	6.6	5.7	5.9	5.8	

Table F.1. (cont'd)

Sept. 30, 1993		PLOT					CROP
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN	MEAN
		ppm					
COMPOST							
soybean	cover[1]	4.3	3.0	2.6	5.1	3.8 [2]	
soybean	no cover	4.3	3.0	2.6	5.1	3.8	3.8
wheat	clover	4.5	4.1	2.8	3.4	3.7	
wheat	no cover	3.6	2.8	3.1	3.4	3.2	3.4
1st year corn	rygr/vetch	3.7	1.8	3.8	2.9	3.0	
1st year corn	no cover	6.2	2.1	4.7	4.5	4.4	3.7
2nd year corn	ryegrass	4.9	3.4	21.2	2.5	8.0	
2nd year corn	no cover	3.9	2.8	1.8	2.6	2.8	5.4
continuous corn	rygr/vetch	4.4	2.2	1.4	2.7	2.7	
continuous corn	no cover	6.0	1.7	3.1	2.7	3.4	3.0
corn rep mean		4.8	2.3	6.0	3.0	4.0	
FERTILIZER							
soybean	cover[1]	2.7	4.6	3.5	4.5	3.8 [2]	
soybean	no cover	2.7	4.6	3.5	4.5	3.8	3.8
wheat	clover	3.3	7.8	5.0	3.9	5.0	
wheat	no cover	8.5	6.7	3.0	1.9	5.0	5.0
1st year corn	rygr/vetch	4.2	4.1	5.2	5.6	4.8	
1st year corn	no cover	4.0	4.9	3.3	6.4	4.6	4.7
2nd year corn	ryegrass	2.9	3.0	2.6	3.6	3.0	
2nd year corn	no cover	4.5	4.8	2.5	5.1	4.2	3.6
continuous corn	rygr/vetch	5.2	5.2	4.2	4.4	4.8	
continuous corn	no cover	2.8	5.0	3.7	3.7	3.8	4.3
corn rep mean		4.0	4.5	3.6	4.8	4.2	
soybean rep mean		3.5	3.8	3.1	4.8	3.8	
wheat rep mean		5.0	5.3	3.4	3.1	4.2	
corn rep mean		4.4	3.4	4.8	3.9	4.1	

Table F.1. (cont'd)

Oct. 27, 1993		PLOT					CROP
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN	MEAN
		ppm					
COMPOST							
soybean	cover[1]	3.4	6.0	5.1	2.6	4.3	
soybean	no cover	4.5	5.9	10.3	4.5	6.3	5.3
wheat	clover	1.6	5.2	3.0	4.8	3.6	
wheat	no cover	2.5	3.5	1.7	2.0	2.4	3.0
1st year corn	rygr/vetch	2.3	3.7	5.3	1.7	3.2	
1st year corn	no cover	1.9	5.7	2.8	1.8	3.0	3.1
2nd year corn	ryegrass	1.7	3.0	1.5	1.9	2.0	
2nd year corn	no cover	2.4	3.0	2.6	3.0	2.7	2.4
continuous corn	rygr/vetch	2.0	3.4	1.2	3.8	2.6	
continuous corn	no cover	2.7	5.0	2.6	2.2	3.1	2.8
corn rep mean		2.1	4.0	2.7	2.4	2.8	
FERTILIZER							
soybean	cover[1]	3.7	3.2	4.0	1.8	3.2	
soybean	no cover	3.4	4.3	4.0	2.1	3.4	3.3
wheat	clover	2.6	4.1	2.5	3.8	3.3	
wheat	no cover	1.9	2.0	6.7	1.3	3.0	3.1
1st year corn	rygr/vetch	1.8	3.9	3.9	2.9	3.1	
1st year corn	no cover	3.5	9.8	6.7	3.8	5.9	4.5
2nd year corn	ryegrass	2.0	2.6	2.5	3.8	2.7	
2nd year corn	no cover	3.0	3.0	1.8	4.7	3.1	2.9
continuous corn	rygr/vetch	3.0	2.3	2.7	3.7	2.9	
continuous corn	no cover	1.9	3.9	3.8	3.2	3.2	3.0
corn rep mean		2.5	4.2	3.6	3.7	3.5	
soybean rep mean		3.8	4.9	5.9	2.8	4.3	
wheat rep mean		2.1	3.7	3.5	3.0	3.1	
corn rep mean		2.3	4.1	3.1	3.0	3.1	

[1] soybean has no cover crop present, but designation shows plot history

[2] plots not split for cover crop

Table F.2. Soil NO_3-N concentrations comparing compost and fertilizer treatments with and without cover crop in 1994.

April 11, 1994				PLOT			CROP
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN	MEAN
		ppm					
COMPOST							
soybean	cover[1]	2.9	4.1	4.9	3.7	3.9	
soybean	no cover	3.1	3.3	3.8	5.5	3.9	3.9
wheat	clover	5.5	6.2	4.3	4.2	5.1	
wheat	no cover	5.7	2.5	6.4	6.1	5.2	5.1
1st year corn	rygr/clover	5.0	6.3	2.6	5.7	4.9	
1st year corn	no cover	2.4	5.1	4.9	5.3	4.4	4.6
2nd year corn	ryegrass	2.0	2.5	2.1	2.5	2.3	
2nd year corn	no cover	4.4	3.1	4.9	4.8	4.3	3.3
continuous corn	rygr/clover	4.6	2.3	2.7	4.6	3.5	
continuous corn	no cover	7.7	5.6	5.3	4.3	5.7	4.6
corn rep mean		4.3	4.1	3.7	4.5	4.2	
FERTILIZER							
soybean	cover[1]	5.1	3.3	4.9	5.0	4.6	
soybean	no cover	6.0	5.4	4.5	9.0	6.2	5.4
wheat	clover	5.1	9.4	5.9	14.1	8.6	
wheat	no cover	5.8	10.7		8.6	8.4	8.5
1st year corn	rygr/clover	2.2	6.1	3.5	3.7	3.9	
1st year corn	no cover	4.2	2.5	20.6	4.7	8.0	5.9
2nd year corn	ryegrass	4.7	4.9	4.1	2.6	4.1	
2nd year corn	no cover	3.0	6.5	8.3	12.0	7.4	5.8
continuous corn	rygr/clover	4.1	4.5	5.4	2.9	4.2	
continuous corn	no cover	2.6	10.6	7.3	5.5	6.5	5.4
corn rep mean		3.5	5.8	8.2	5.2	5.7	
soybean rep mean		4.3	4.0	4.5	5.8	4.7	
wheat rep mean		5.5	7.2	5.5	8.3	6.8	
corn rep mean		3.9	5.0	6.0	4.9	4.9	

Table F.2. (cont'd)

May 4, 1994		PLOT					CROP
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN	MEAN
		ppm					
COMPOST							
soybean	cover[1]	1.8	2.4	2.7	3.5	2.6	
soybean	no cover	4.2	4.0	3.9	3.9	4.0	3.3
wheat	clover	2.3	2.7	3.2	2.2	2.6	
wheat	no cover	2.6	2.4	3.6	2.0	2.6	2.6
1st year corn	rygr/clover	4.3	14.7	7.0	3.4	7.3	
1st year corn	no cover	3.5	6.0	2.8	4.2	4.1	5.7
2nd year corn	ryegrass	3.9	2.6	3.2	2.8	3.1	
2nd year corn	no cover	4.3	3.6	4.2	3.0	3.8	3.5
continuous corn	rygr/clover	4.0	3.5	3.0	2.4	3.2	
continuous corn	no cover	5.7	3.3	3.9	3.9	4.2	3.7
corn rep mean		4.3	5.6	4.0	3.3	4.3	
FERTILIZER							
soybean	cover[1]	3.3	2.7	3.0	3.9	3.2	
soybean	no cover	5.5	5.1	4.3	5.8	5.2	4.2
wheat	clover	9.2	7.6	6.2	12.9	9.0	
wheat	no cover	8.7	10.6	7.0	12.1	9.6	9.3
1st year corn	rygr/clover	3.5	3.3	2.6	3.4	3.2	
1st year corn	no cover	4.4	4.0	2.6	4.7	3.9	3.6
2nd year corn	ryegrass	3.7	3.1	3.1	4.0	3.5	
2nd year corn	no cover	6.6	6.5	4.8	5.9	5.9	4.7
continuous corn	rygr/clover	3.9	3.9	2.8	3.2	3.4	
continuous corn	no cover	4.9	5.1	5.3	4.3	4.9	4.1
corn rep mean		4.5	4.3	3.5	4.2	4.1	
soybean rep mean		3.7	3.5	3.5	4.3	3.7	
wheat rep mean		5.7	5.8	5.0	7.3	5.9	
corn rep mean		4.4	5.0	3.8	3.7	4.2	

Table F.2. (cont'd)

May 17, 1994		PLOT					CROP
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN	MEAN
		ppm					
COMPOST							
soybean	cover[1]	2.7	2.9	2.8	3.9	3.1	
soybean	no cover	4.2	4.3	3.6	4.6	4.2	3.6
wheat	clover	1.6	1.0	1.7	1.7	1.5	
wheat	no cover	1.7	2.2	1.4	2.0	1.8	1.6
1st year corn	rygr/clover	4.7	9.0	6.1	10.7	7.6	
1st year corn	no cover	5.6	4.8	4.6	7.6	5.7	6.6
2nd year corn	ryegrass	2.7	2.7	3.0	3.3	2.9	
2nd year corn	no cover	4.9	3.6	5.1	3.5	4.3	3.6
continuous corn	rygr/clover	4.2	3.3	3.1	2.8	3.3	
continuous corn	no cover	5.6	4.6	4.6	4.3	4.8	4.1
corn rep mean		4.6	4.7	4.4	5.4	4.8	
FERTILIZER							
soybean	cover[1]	4.2	3.2	3.7	4.0	3.8	
soybean	no cover	5.1	5.3	6.0	5.0	5.3	4.6
wheat	clover	6.7	6.2	1.7	6.1	5.2	
wheat	no cover	2.2	5.9	4.0	6.4	4.6	4.9
1st year corn	rygr/clover	7.0	8.4	5.6	8.2	7.3	
1st year corn	no cover	8.0	5.5	9.8	5.7	7.3	7.3
2nd year corn	ryegrass	6.1	5.9	4.1	4.8	5.2	
2nd year corn	no cover	7.5	7.2	6.6	7.6	7.2	6.2
continuous corn	rygr/clover	5.2	3.8	6.5	2.6	4.5	
continuous corn	no cover	4.5	4.7	4.3	8.0	5.4	5.0
corn rep mean		6.4	5.9	6.2	6.1	6.1	
soybean rep mean		4.0	3.9	4.0	4.4	4.1	
wheat rep mean		3.0	3.8	2.2	4.0	3.3	
corn rep mean		5.5	5.3	5.3	5.8	5.5	

Table F.2. (cont'd)

June 10, 1994		PLOT					CROP
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN	MEAN
		ppm					
COMPOST							
soybean	cover[1]	7.2	8.8	3.3	2.6	5.5	
soybean	no cover	6.5	6.4	5.0	7.4	6.3	5.9
wheat	clover	1.6	2.2	3.3	3.7	2.7	
wheat	no cover	2.5	2.3	1.8	2.8	2.3	2.5
1st year corn	rygr/clover	12.9	8.3	4.7	10.2	9.0	
1st year corn	no cover	12.1	9.2	8.4	6.5	9.0	9.0
2nd year corn	ryegrass	7.2	4.3	5.3	2.1	4.7	
2nd year corn	no cover	7.6	3.0	7.8	3.1	5.4	5.0
continuous corn	rygr/clover	4.3	6.1	5.8	1.9	4.5	
continuous corn	no cover	8.3	5.5	7.6	5.3	6.7	5.6
corn rep mean		8.7	6.1	6.6	4.8	6.5	
FERTILIZER							
soybean	cover[1]	7.3	10.7	7.5	8.1	8.4	
soybean	no cover	7.8	9.3	9.3	4.7	7.7	8.1
wheat	clover	6.7	4.5	1.1	8.3	5.1	
wheat	no cover	2.3	2.4	3.1	5.0	3.2	4.2
1st year corn	rygr/clover	9.2	6.1	10.3	14.7	10.1	
1st year corn	no cover	10.7	10.0	10.7	6.4	9.4	9.8
2nd year corn	ryegrass	7.4	4.9	6.8	7.0	6.5	
2nd year corn	no cover	5.9	8.0	5.2	7.0	6.5	6.5
continuous corn	rygr/clover	8.7	7.7	4.9	6.7	7.0	
continuous corn	no cover	7.8	5.5	6.0	5.0	6.1	6.5
corn rep mean		8.3	7.0	7.3	7.8	7.6	
soybean rep mean		7.2	8.8	6.3	5.7	7.0	
wheat rep mean		3.2	2.8	2.3	4.9	3.3	
corn rep mean		8.5	6.5	7.0	6.3	7.1	

Table F.2. (cont'd)

July 11, 1994		PLOT					CROP
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN	MEAN
		ppm					
COMPOST							
soybean	cover[1]	3.1	4.2	1.9	4.1	3.3	
soybean	no cover	8.2	3.2	2.6	5.2	4.8	4.0
wheat	clover	3.5	3.2	2.3	4.4	3.3	
wheat	no cover	4.3	4.2	3.3	3.6	3.9	3.6
1st year corn	rygr/clover	5.7	4.4	2.0	3.6	3.9	
1st year corn	no cover	4.1	5.2	3.2	6.1	4.6	4.3
2nd year corn	ryegrass	3.3	2.5	3.8	2.6	3.0	
2nd year corn	no cover	2.6	5.6	3.6	2.6	3.6	3.3
continuous corn	rygr/clover	5.7	3.0	3.6	3.6	4.0	
continuous corn	no cover	3.8	2.9	2.3	6.8	4.0	4.0
corn rep mean		4.2	3.9	3.1	4.2	3.9	
FERTILIZER							
soybean	cover[1]	4.8	5.1	3.2	5.0	4.5	
soybean	no cover	3.6	4.3	5.3	4.8	4.5	4.5
wheat	clover	1.6	3.0	2.8	4.5	3.0	
wheat	no cover	4.2	4.1	4.8	4.0	4.3	3.6
1st year corn	rygr/clover	8.1	17.6	9.6	5.3	10.1	
1st year corn	no cover	11.6	7.6	9.8	6.5	8.9	9.5
2nd year corn	ryegrass	9.5	8.8	12.5	7.2	9.5	
2nd year corn	no cover	6.8	9.3	16.8	4.6	9.4	9.4
continuous corn	rygr/clover	11.0	4.0	8.0	2.8	6.4	
continuous corn	no cover	5.5	3.7	7.0	5.7	5.5	5.9
corn rep mean		8.7	8.5	10.6	5.3	8.3	
soybean rep mean		4.9	4.2	3.3	4.7	4.3	
wheat rep mean		3.4	3.6	3.3	4.1	3.6	
corn rep mean		6.5	6.2	6.8	4.8	6.1	

Table F.2. (cont'd)

Oct. 3, 1994		PLOT					CROP
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN	MEAN
		ppm					
COMPOST							
soybean	cover[1]	3.7	3.9	5.4	2.5	3.9	
soybean	no cover	3.4	4.5	1.9	2.6	3.1	3.5
wheat	clover	4.4	4.2	2.7	3.1	3.6	
wheat	no cover	4.0	1.6	2.3	2.2	2.5	3.1
1st year corn	rygr/clover	2.2	1.1	1.0	2.5	1.7	
1st year corn	no cover	1.7	1.2	1.4	2.2	1.6	1.6
2nd year corn	ryegrass	2.9	1.0	1.4	13.0	4.6	
2nd year corn	no cover	3.3	1.3	2.5	1.2	2.1	3.3
continuous corn	rygr/clover	1.5	2.5	2.9	11.2	4.5	
continuous corn	no cover	2.3	2.0	1.4	10.9	4.1	4.3
corn rep mean		2.3	1.5	1.8	6.8	3.1	
FERTILIZER							
soybean	cover[1]	2.2	2.5	3.6	3.8	3.0	
soybean	no cover	21.3	1.7	3.0	3.8	7.4	5.2
wheat	clover	1.5	2.1	1.5	2.7	1.9	
wheat	no cover	1.9	2.0	2.1	1.6	1.9	1.9
1st year corn	rygr/clover	2.6	3.0	1.9	2.1	2.4	
1st year corn	no cover	2.7	2.8	2.6	1.4	2.4	2.4
2nd year corn	ryegrass	2.5	2.6	1.8	13.8	5.2	
2nd year corn	no cover	3.0	21.9	3.0	1.7	7.4	6.3
continuous corn	rygr/clover	3.5	1.1	3.9	1.8	2.6	
continuous corn	no cover	2.6	1.0	4.6	2.1	2.6	2.6
corn rep mean		2.8	5.4	2.9	3.8	3.7	
soybean rep mean		7.6	3.1	3.5	3.2	4.4	
wheat rep mean		2.9	2.5	2.1	2.4	2.5	
corn rep mean		2.6	3.5	2.4	5.3	3.4	

Table F.2. (cont'd)

Nov. 8, 1994		PLOT					CROP
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN	MEAN
		ppm					
COMPOST							
soybean	cover[1]	4.2	3.8	3.8	3.7	3.9	
soybean	no cover	5.2	15.4	7.4	4.9	8.2	6.0
wheat	clover	3.0	4.1	2.8	3.5	3.4	
wheat	no cover	6.4	2.8	3.4	3.0	3.9	3.6
1st year corn	rygr/clover	3.2	0.7	2.6	5.4	3.0	
1st year corn	no cover	3.9	0.4	2.9	4.4	2.9	2.9
2nd year corn	ryegrass	3.7	2.9	3.1	3.0	3.2	
2nd year corn	no cover	2.6	2.1	3.1	1.6	2.3	2.7
continuous corn	rygr/clover	4.3	3.7	3.6	1.1	3.2	
continuous corn	no cover	4.0	5.1	2.9	3.0	3.7	3.4
corn rep mean		3.6	2.5	3.0	3.1	3.0	
FERTILIZER							
soybean	cover[1]	4.0	11.0	6.1	4.8	6.5	
soybean	no cover	4.9	4.1	7.2	8.2	6.1	6.3
wheat	clover	4.3	5.4	2.1	5.0	4.2	
wheat	no cover	5.3	4.3	3.9	3.7	4.3	4.3
1st year corn	rygr/clover	4.9	1.0	3.4	4.5	3.5	
1st year corn	no cover	6.0	5.8	4.0	6.6	5.6	4.5
2nd year corn	ryegrass	5.7	4.9	5.0	2.7	4.6	
2nd year corn	no cover	4.3	3.7	2.9	4.9	3.9	4.3
continuous corn	rygr/clover	4.3	2.6	2.2	2.1	2.8	
continuous corn	no cover	4.2	4.8	5.0	5.4	4.8	3.8
corn rep mean		4.9	3.8	3.7	4.4	4.2	
soybean rep mean		4.6	8.6	6.1	5.4	6.2	
wheat rep mean		4.8	4.2	3.1	3.8	4.0	
corn rep mean		4.2	3.1	3.4	3.7	3.6	

[1] soybean has no cover crop present, but designation shows plot history

Appendix G

Lysimeter Data

Table G.1. Lysimeter leachate volumes comparing compost and fertilizer treatments on each sampling date in 1993.

Nov. 25, 1992- Jan. 11, 1993		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		ml				
COMPOST						
soybean	cover[1]	1300	1220	4300	480	1830
wheat	clover	1300	870	8720	1140	3010
1st year corn	rygr/vetch	4600	1600	3640	3000	3210
2nd year corn	ryegrass	680	1800	1900	500	1220
continuous corn	rygr/vetch	1260	1240	7000	0	2380
rep means		1830	1350	5110	1020	2330
FERTILIZER						
soybean	cover[1]	5400	780	2500	1320	2500
wheat	clover	880	980	2800	960	1410
1st year corn	rygr/vetch	7800	1240	2560	380	3000
2nd year corn	ryegrass	8140	1060	10060	4600	5970
continuous corn	rygr/vetch	2800	4200	1160	500	2170
rep means		5000	1650	3820	1550	3010
rep means		3420	1500	4460	1290	2670

Jan. 12- March 2, 1993		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		ml				
COMPOST						
soybean	cover[1]	23000	0	1100	0	6030
wheat	clover	100	0	100	100	80
1st year corn	rygr/vetch	600	100	150	200	260
2nd year corn	ryegrass	900	3700	50	200	1210
continuous corn	rygr/vetch	500	3300	1100	300	1300
rep means		5020	1420	500	160	1780
FERTILIZER						
soybean	cover[1]	2600	16600	23100	0	10580
wheat	clover	1200	250	0	200	410
1st year corn	rygr/vetch	550	700	100	0	340
2nd year corn	ryegrass	6000	0	0	3700	2430
continuous corn	rygr/vetch	500	1650	0	0	540
rep means		2170	3840	4640	780	2860
rep means		3600	2630	2570	470	2320

Table G.1. (cont'd)

March 3- April 12, 1993		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		ml				
COMPOST						
soybean	cover[1]	100	400	2900	300	930
wheat	clover	0	0	300	12450	3190
1st year corn	rygr/vetch	200	0	200	4300	1180
2nd year corn	ryegrass	22700	900	500	18900	10750
continuous corn	rygr/vetch	22400	12400	1600	0	9100
rep means		9080	2740	1100	7190	5030
FERTILIZER						
soybean	cover[1]	22500	200	23200	100	11500
wheat	clover	23000	23400	200	200	11700
1st year corn	rygr/vetch	23300	50	28500	0	12960
2nd year corn	ryegrass	23300	100	700	1600	6430
continuous corn	rygr/vetch	5000	23200	100	13500	10450
rep means		19420	9390	10540	3080	10610
rep means		14250	6070	5820	5140	7820

April 13- June 10, 1993		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		ml				
COMPOST						
soybean	cover[1]	500	1250	3200	300	1310
wheat	clover	0	0	1200	1700	730
1st year corn	rygr/vetch	1850	550	1700	6100	2550
2nd year corn	ryegrass	500	8200	1000	1800	2880
continuous corn	rygr/vetch	550	600	2300	400	960
rep means		680	2120	1880	2060	1690
FERTILIZER						
soybean	cover[1]	1800	1700	2300	5250	2760
wheat	clover	1200	200	1750	1300	1110
1st year corn	rygr/vetch	2600	0	1400	1000	1250
2nd year corn	ryegrass	2300	0	4000	2400	2180
continuous corn	rygr/vetch	1500	700	200	300	680
rep means		1880	520	1930	2050	1600
rep means		1280	1320	1910	2060	1640

Table G.1. (cont'd)

June 11- July 7, 1993		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		ml				
COMPOST						
soybean	cover[1]	0	2900	1700	100	1180
wheat	clover	0	0	50	50	30
1st year corn	rygr/vetch	1350	0	1600	3700	1660
2nd year corn	ryegrass	0	1100	900	2400	1100
continuous corn	rygr/vetch	0	200	2350	250	700
rep means		270	840	1320	1300	930
FERTILIZER						
soybean	cover[1]	1400	3300	3750	100	2140
wheat	clover	500	0	300	0	200
1st year corn	rygr/vetch	2000	0	2300	200	1130
2nd year corn	ryegrass	2300	1800	1000	2300	1850
continuous corn	rygr/vetch	2700	200	500	0	850
rep means		1780	1060	1570	520	1230
rep means		1030	950	1450	910	1080

July 8- Sept. 22, 1993		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		ml				
COMPOST						
soybean	cover[1]	3400	50	550	500	1130
wheat	clover	0	0	300	0	80
1st year corn	rygr/vetch	450	200	350	0	250
2nd year corn	ryegrass	50	0	250	800	280
continuous corn	rygr/vetch	0	1800	0	100	480
rep means		780	410	290	280	440
FERTILIZER						
soybean	cover[1]	400	800	550	400	540
wheat	clover	0	0	300	0	80
1st year corn	rygr/vetch	0	50	350	0	100
2nd year corn	ryegrass	0	600	2700	0	830
continuous corn	rygr/vetch	500	0	50	300	210
rep means		180	290	790	140	350
rep means		480	350	540	210	400

Table G.1. (cont'd)

Sept. 23- Oct. 26, 1993		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		ml				
COMPOST						
soybean	cover[1]	250	3700	950	0	1230
wheat	clover	2800	0	450	300	900
1st year corn	rygr/vetch	2650	0	0	1100	940
2nd year corn	ryegrass	0	0	4000	0	1000
continuous corn	rygr/vetch	0	700	2600	2800	1530
rep means		1140	880	1600	840	1120
FERTILIZER						
soybean	cover[1]	750	1800	1300	0	960
wheat	clover	4300	2350	5700	0	3090
1st year corn	rygr/vetch	700	0	50	0	190
2nd year corn	ryegrass	1300	450	9900	3650	3840
continuous corn	rygr/vetch	4600	1600	0	0	1550
rep means		2330	1240	3390	730	1930
rep means		1740	1060	2500	790	1520

Oct. 27- Nov. 30, 1993		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		ml				
COMPOST						
soybean	cover[1]	0	0	300	0	80
wheat	clover	500	0	200	0	180
1st year corn	rygr/vetch	800	50	0	300	290
2nd year corn	ryegrass	0	13900	700	250	3710
continuous corn	rygr/vetch	0	500	500	0	250
rep means		260	2890	340	110	900
FERTILIZER						
soybean	cover[1]	300	0	325	50	170
wheat	clover	500	300	700	0	380
1st year corn	rygr/vetch	0	0	50	0	10
2nd year corn	ryegrass	300	100	900	0	330
continuous corn	rygr/vetch	500	0	200	0	180
rep means		320	80	440	10	210
rep means		290	1490	390	60	560

[1] soybean has no cover crop present, but designation shows plot history

Table G.2. Lysimeter leachate NO_3-N concentrations comparing compost and fertilizer treatments on each sampling date in 1993.

Nov. 25, 1992- Jan. 11, 1993		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		ppm in water				
COMPOST						
soybean	cover[1]	19.0	72.3	55.1	7.5	38.5
wheat	clover	56.9	59.0	80.5	27.8	56.0
1st year corn	rygr/vetch	80.9	65.1	59.5	75.1	70.1
2nd year corn	ryegrass	48.0	84.3	88.9	7.8	57.2
continuous corn	rygr/vetch	77.9	26.0	66.8	0.0	42.7
rep means		56.5	61.3	70.2	23.6	52.9
FERTILIZER						
soybean	cover[1]	37.8	30.7	60.0	35.4	41.0
wheat	clover	18.0	7.9	45.3	53.7	31.2
1st year corn	rygr/vetch	80.9	11.8	78.9	17.7	47.3
2nd year corn	ryegrass	78.8	72.9	80.8	72.1	76.1
continuous corn	rygr/vetch	74.9	58.2	32.9	17.5	45.9
rep means		58.1	36.3	59.6	39.3	48.3
rep means		57.3	48.8	64.9	31.5	50.6

Jan. 12- March 2, 1993		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		ppm in water				
COMPOST						
soybean	cover[1]	1.0	0.0	50.9	0.0	13.0
wheat	clover	60.2	0.0	127.3	17.6	51.3
1st year corn	rygr/vetch	131.3	82.8	84.3	103.8	100.5
2nd year corn	ryegrass	48.5	156.8	51.4	6.4	65.7
continuous corn	rygr/vetch	116.9	1.8	84.5	3.4	51.6
rep means		71.6	48.3	79.7	26.2	56.4
FERTILIZER						
soybean	cover[1]	36.3	2.3	5.0	0.0	10.9
wheat	clover	21.5	10.9	0.0	46.5	19.7
1st year corn	rygr/vetch	139.5	10.8	113.7	0.0	66.0
2nd year corn	ryegrass	6.3	0.0	0.0	78.1	21.1
continuous corn	rygr/vetch	108.1	84.9	0.0	0.0	48.3
rep means		62.4	21.8	23.7	24.9	33.2
rep means		67.0	35.0	51.7	25.6	44.8

Table G.2. (cont'd)

March 3- April 12, 1993		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		ppm in water				
COMPOST						
soybean	cover[1]	5.1	116.2	53.3	13.3	47.0
wheat	clover	0.0	0.0	109.0	49.6	39.6
1st year corn	rygr/vetch	129.2	0.0	66.0	42.9	59.5
2nd year corn	ryegrass	3.6	129.6	197.9	2.1	83.3
continuous corn	rygr/vetch	1.5	1.5	68.7	0.0	17.9
rep means		27.9	49.4	99.0	21.6	49.5
FERTILIZER						
soybean	cover[1]	2.2	11.0	2.1	16.9	8.0
wheat	clover	2.3	1.1	36.5	10.2	12.5
1st year corn	rygr/vetch	3.3	66.9	2.6	0.0	18.2
2nd year corn	ryegrass	13.0	82.5	64.7	67.7	57.0
continuous corn	rygr/vetch	1.3	1.5	22.3	0.6	6.4
rep means		4.4	32.6	25.6	19.1	20.4
rep means		16.1	41.0	62.3	20.3	34.9

April 13- June 10, 1993		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		ppm in water				
COMPOST						
soybean	cover[1]	40.9	134.9	35.2	16.5	56.9
wheat	clover	0.0	0.0	100.5	88.4	47.2
1st year corn	rygr/vetch	127.3	99.1	70.4	70.5	91.8
2nd year corn	ryegrass	15.7	78.5	211.6	14.4	80.0
continuous corn	rygr/vetch	84.7	15.8	61.3	8.3	42.5
rep means		53.7	65.6	95.8	39.6	63.7
FERTILIZER						
soybean	cover[1]	27.9	37.4	57.4	40.8	40.8
wheat	clover	39.1	15.2	42.6	88.8	46.4
1st year corn	rygr/vetch	120.6	0.0	95.5	36.8	63.2
2nd year corn	ryegrass	58.6	0.0	47.9	56.3	40.7
continuous corn	rygr/vetch	150.8	75.1	38.2	14.2	69.6
rep means		79.4	25.5	56.3	47.4	52.2
rep means		66.6	45.6	76.0	43.5	57.9

Table G.2. (cont'd)

June 11- July 7, 1993		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		----------ppm in water----------				
COMPOST						
soybean	cover[1]	0.0	124.6	43.4	16.5	46.1
wheat	clover	0.0	0.0	94.8	62.1	39.2
1st year corn	rygr/vetch	119.4	0.0	73.0	55.1	61.9
2nd year corn	ryegrass	0.0	54.5	211.9	34.2	75.2
continuous corn	rygr/vetch	0.0	64.1	67.7	7.4	34.8
rep means		23.9	48.6	98.2	35.1	51.4
FERTILIZER						
soybean	cover[1]	40.4	64.9	70.1	47.8	55.8
wheat	clover	31.0	0.0	51.0	0.0	20.5
1st year corn	rygr/vetch	115.0	0.0	109.8	36.2	65.2
2nd year corn	ryegrass	68.2	145.6	38.1	44.4	74.1
continuous corn	rygr/vetch	151.3	98.6	39.6	0.0	72.4
rep means		81.2	61.8	61.7	25.7	57.6
rep means		52.5	55.2	79.9	30.4	54.5

July 8- Sept. 22, 1993		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		----------ppm in water----------				
COMPOST						
soybean	cover[1]	80.5	121.7	45.5	17.8	66.4
wheat	clover	0.0	0.0	103.5	0.0	25.9
1st year corn	rygr/vetch	117.3	121.7	71.5	0.0	77.6
2nd year corn	ryegrass	20.9	0.0	147.2	34.4	50.6
continuous corn	rygr/vetch	0.0	61.4	0.0	24.2	21.4
rep means		43.7	61.0	73.5	15.3	48.4
FERTILIZER						
soybean	cover[1]	45.4	61.8	75.2	45.6	57.0
wheat	clover	0.0	0.0	48.9	0.0	12.2
1st year corn	rygr/vetch	0.0	24.1	116.4	0.0	35.1
2nd year corn	ryegrass	0.0	0.0	13.8	0.0	3.5
continuous corn	rygr/vetch	146.6	0.0	34.5	17.5	49.6
rep means		38.4	17.2	57.8	12.6	31.5
rep means		41.1	39.1	65.6	14.0	39.9

Table G.2. (cont'd)

Sept. 23- Oct. 26, 1993		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		ppm in water				
COMPOST						
soybean	cover[1]	90.1	90.1	34.1	0.0	53.6
wheat	clover	35.3	0.0	38.5	95.0	42.2
1st year corn	rygr/vetch	2.5	0.0	0.0	16.1	4.7
2nd year corn	ryegrass	0.0	0.0	58.1	0.0	14.5
continuous corn	rygr/vetch	0.0	43.6	10.7	3.8	14.5
rep means		25.6	26.7	28.3	23.0	25.9
FERTILIZER						
soybean	cover[1]	44.8	50.5	48.6	0.0	36.0
wheat	clover	10.4	26.8	6.4	0.0	10.9
1st year corn	rygr/vetch	91.7	0.0	114.8	0.0	51.6
2nd year corn	ryegrass	38.7	89.8	3.3	38.8	42.6
continuous corn	rygr/vetch	54.5	88.0	0.0	0.0	35.6
rep means		48.0	51.0	34.6	7.8	35.3
rep means		36.8	38.9	31.4	15.4	30.6

Oct. 27- Nov. 30, 1993		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		ppm in water				
COMPOST						
soybean	cover[1]	0.0	0.0	36.9	0.0	9.2
wheat	clover	34.5	0.0	40.1	0.0	18.6
1st year corn	rygr/vetch	4.7	37.2	0.0	10.9	13.2
2nd year corn	ryegrass	0.0	3.8	115.3	6.6	31.4
continuous corn	rygr/vetch	0.0	49.8	5.0	0.0	13.7
rep means		7.8	18.1	39.5	3.5	17.2
FERTILIZER						
soybean	cover[1]	52.1	0.0	54.4	130.3	59.2
wheat	clover	9.5	34.6	8.3	0.0	13.1
1st year corn	rygr/vetch	0.0	0.0	77.8	0.0	19.4
2nd year corn	ryegrass	50.3	91.8	5.1	0.0	36.8
continuous corn	rygr/vetch	53.5	0.0	43.8	0.0	24.3
rep means		33.1	25.3	37.8	26.1	30.6
rep means		20.5	21.7	38.6	14.8	23.9

[1] soybean has no cover crop present, but designation shows plot history

Table G.3. Calculated lysimeter NO_3-N leachate losses per acre comparing compost and fertilizer treatments on each sampling date in 1993.

Nov. 25, 1992- Jan. 11, 1993		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		lbs NO_3-N/acre				
COMPOST						
soybean	cover[1]	3.0	10.8	29.0	0.4	10.8
wheat	clover	9.1	6.3	85.9	3.9	26.3
1st year corn	rygr/vetch	45.5	12.7	26.5	27.6	28.1
2nd year corn	ryegrass	4.0	18.6	20.7	0.5	10.9
continuous corn	rygr/vetch	12.0	3.9	57.2	0.0	18.3
rep means		14.7	10.5	43.8	6.5	18.9
FERTILIZER						
soybean	cover[1]	25.0	2.9	18.3	5.7	13.0
wheat	clover	1.9	0.9	15.5	6.3	6.2
1st year corn	rygr/vetch	77.2	1.8	24.7	0.8	26.1
2nd year corn	ryegrass	78.4	9.5	99.4	40.5	57.0
continuous corn	rygr/vetch	25.6	29.9	4.7	1.1	15.3
rep means		41.6	9.0	32.5	10.9	23.5
rep means		28.2	9.7	38.2	8.7	21.2

Jan. 12- March 2, 1993		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		lbs NO_3-N/acre				
COMPOST						
soybean	cover[1]	2.8	0.0	6.9	0.0	2.4
wheat	clover	0.7	0.0	1.6	0.2	0.6
1st year corn	rygr/vetch	9.6	1.0	1.6	2.5	3.7
2nd year corn	ryegrass	5.3	70.9	0.3	0.2	19.2
continuous corn	rygr/vetch	7.2	0.7	11.4	0.1	4.8
rep means		5.1	14.5	4.3	0.6	6.1
FERTILIZER						
soybean	cover[1]	11.5	4.7	14.1	0.0	7.6
wheat	clover	3.2	0.3	0.0	1.1	1.2
1st year corn	rygr/vetch	9.4	0.9	1.4	0.0	2.9
2nd year corn	ryegrass	4.6	0.0	0.0	35.3	10.0
continuous corn	rygr/vetch	6.6	17.1	0.0	0.0	5.9
rep means		7.1	4.6	3.1	7.3	5.5
rep means		6.1	9.6	3.7	4.0	5.8

Table G.3. (cont'd)

March 3- April 12, 1993		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		lbs NO_3-N/acre				
COMPOST						
soybean	cover[1]	0.1	5.7	18.9	0.3	6.2
wheat	clover	0.0	0.0	4.0	75.5	19.9
1st year corn	rygr/vetch	3.2	0.0	1.6	22.5	6.8
2nd year corn	ryegrass	9.9	14.3	12.1	4.9	10.3
continuous corn	rygr/vetch	4.2	2.2	13.4	0.0	5.0
rep means		3.5	4.4	10.0	20.6	9.6
FERTILIZER						
soybean	cover[1]	5.9	0.3	5.9	0.2	3.1
wheat	clover	6.5	3.2	0.9	0.3	2.7
1st year corn	rygr/vetch	9.4	0.4	9.0	0.0	4.7
2nd year corn	ryegrass	36.9	1.0	5.5	13.2	14.2
continuous corn	rygr/vetch	0.8	4.3	0.3	0.9	1.6
rep means		11.9	1.8	4.3	2.9	5.2
rep means		7.7	3.1	7.2	11.8	7.4

April 13- June 10, 1993		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		lbs NO_3-N/acre				
COMPOST						
soybean	cover[1]	2.5	20.6	13.8	0.4	9.3
wheat	clover	0.0	0.0	14.7	18.4	8.3
1st year corn	rygr/vetch	28.8	6.7	14.6	52.6	25.7
2nd year corn	ryegrass	1.0	78.7	25.9	3.2	27.2
continuous corn	rygr/vetch	5.7	1.2	17.2	0.4	6.1
rep means		7.6	21.4	17.3	15.0	15.3
FERTILIZER						
soybean	cover[1]	6.1	7.8	16.1	26.2	14.1
wheat	clover	5.7	0.4	9.1	14.1	7.3
1st year corn	rygr/vetch	38.4	0.0	16.4	4.5	14.8
2nd year corn	ryegrass	16.5	0.0	23.5	16.5	14.1
continuous corn	rygr/vetch	27.7	6.4	0.9	0.5	8.9
rep means		18.9	2.9	13.2	12.4	11.8
rep means		13.2	12.2	15.2	13.7	13.6

Table G.3. (cont'd)

June 11- July 7, 1993		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		lbs NO_3-N/acre				
COMPOST						
soybean	cover[1]	0.0	44.2	9.0	0.2	13.4
wheat	clover	0.0	0.0	0.6	0.4	0.2
1st year corn	rygr/vetch	19.7	0.0	14.3	25.0	14.7
2nd year corn	ryegrass	0.0	7.3	23.3	10.1	10.2
continuous corn	rygr/vetch	0.0	1.6	19.5	0.2	5.3
rep means		3.9	10.6	13.3	7.2	8.8
FERTILIZER						
soybean	cover[1]	6.9	26.2	32.1	0.6	16.5
wheat	clover	1.9	0.0	1.9	0.0	0.9
1st year corn	rygr/vetch	28.1	0.0	30.9	0.9	15.0
2nd year corn	ryegrass	10.0	32.1	4.7	12.5	14.8
continuous corn	rygr/vetch	50.0	2.4	2.4	0.0	13.7
rep means		19.4	12.1	14.4	2.8	12.2
rep means		11.7	11.4	13.9	5.0	10.5

July 8- Sept. 22, 1993		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		lbs NO_3-N/acre				
COMPOST						
soybean	cover[1]	33.5	0.7	3.1	1.1	9.6
wheat	clover	0.0	0.0	3.8	0.0	1.0
1st year corn	rygr/vetch	6.5	3.0	3.1	0.0	3.1
2nd year corn	ryegrass	0.1	0.0	4.5	3.4	2.0
continuous corn	rygr/vetch	0.0	13.5	0.0	0.3	3.5
rep means		8.0	3.4	2.9	1.0	3.8
FERTILIZER						
soybean	cover[1]	2.2	6.0	5.1	2.2	3.9
wheat	clover	0.0	0.0	1.8	0.0	0.4
1st year corn	rygr/vetch	0.0	0.2	5.0	0.0	1.3
2nd year corn	ryegrass	0.0	10.9	4.6	0.0	3.9
continuous corn	rygr/vetch	9.0	0.0	0.2	0.6	2.5
rep means		2.2	3.4	3.3	0.6	2.4
rep means		5.1	3.4	3.1	0.8	3.1

Table G.3. (cont'd)

Sept. 23- Oct. 26, 1993		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		lbs NO_3-N/acre				
COMPOST						
soybean	cover[1]	2.8	40.8	4.0	0.0	11.9
wheat	clover	12.1	0.0	2.1	4.4	4.6
1st year corn	rygr/vetch	0.8	0.0	0.0	2.2	0.7
2nd year corn	ryegrass	0.0	0.0	28.4	0.0	7.1
continuous corn	rygr/vetch	0.0	3.7	3.4	1.3	2.1
rep means		3.1	8.9	7.6	1.6	5.3
FERTILIZER						
soybean	cover[1]	4.1	11.1	7.7	0.0	5.7
wheat	clover	5.5	7.7	4.4	0.0	4.4
1st year corn	rygr/vetch	7.9	0.0	0.7	0.0	2.1
2nd year corn	ryegrass	6.2	4.9	4.0	17.3	8.1
continuous corn	rygr/vetch	30.7	17.2	0.0	0.0	12.0
rep means		10.8	8.2	3.4	3.5	6.5
rep means		7.0	8.5	5.5	2.5	5.9

Oct. 27- Nov. 30, 1993		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		lbs NO_3-N/acre				
COMPOST						
soybean	cover[1]	0.0	0.0	1.4	0.0	0.3
wheat	clover	2.1	0.0	1.0	0.0	0.8
1st year corn	rygr/vetch	0.5	0.2	0.0	0.4	0.3
2nd year corn	ryegrass	0.0	6.5	9.9	0.2	4.1
continuous corn	rygr/vetch	0.0	3.0	0.3	0.0	0.8
rep means		0.5	1.9	2.5	0.1	1.3
FERTILIZER						
soybean	cover[1]	1.9	0.0	2.2	0.8	1.2
wheat	clover	0.6	1.3	0.7	0.0	0.6
1st year corn	rygr/vetch	0.0	0.0	0.5	0.0	0.1
2nd year corn	ryegrass	1.9	1.1	0.6	0.0	0.9
continuous corn	rygr/vetch	3.3	0.0	1.1	0.0	1.1
rep means		1.5	0.5	1.0	0.2	0.8
rep means		1.0	1.2	1.7	0.1	1.0

[1] soybean has no cover crop present, but designation shows plot history

Table G.4. Lysimeter leachate volumes comparing compost and fertilizer treatments on each sampling date in 1994.

Dec. 1, 1993- March 2, 1994		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		ml				
COMPOST						
soybean	cover[1]	0	23200	5800	6300	8830
wheat	clover	600	500	800	0	480
1st year corn	rygr/clove	4800	6100	6600	5000	5630
2nd year corn	ryegrass	19600	1500	4900	5600	7900
continuous corn	rygr/clove	7200	1650	11300	700	5210
rep means		6440	6590	5880	3520	5610
FERTILIZER						
soybean	cover[1]	10800	2200	9600	8200	7700
wheat	clover	800	200	0	2400	850
1st year corn	rygr/clove	6300	7400	8500	3250	6360
2nd year corn	ryegrass	9400	400	5600	1800	4300
continuous corn	rygr/clove	2900	2550	3350	3200	3000
rep means		6040	2550	5410	3770	4440
rep means		6240	4570	5650	3650	5030

March 3- April 4, 1994		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		ml				
COMPOST						
soybean	cover[1]	0	23400	8700	3200	8830
wheat	clover	300	0	500	0	200
1st year corn	rygr/clove	2400	2000	2400	2900	2430
2nd year corn	ryegrass	7250	950	1800	2200	3050
continuous corn	rygr/clove	900	200	4700	1000	1700
rep means		2170	5310	3620	1860	3240
FERTILIZER						
soybean	cover[1]	4300	450	3700	2500	2740
wheat	clover	100	200	0	0	80
1st year corn	rygr/clove	6000	2750	500	2400	2910
2nd year corn	ryegrass	4700	600	3900	1500	2680
continuous corn	rygr/clove	1700	3250	2500	1500	2240
rep means		3360	1450	2120	1580	2130
rep means		2770	3380	2870	1720	2690

Table G.4. (cont'd)

April 5- June 27, 1994		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		ml				
COMPOST						
soybean	cover[1]	500	6000	12400	750	4910
wheat	clover	50	0	0	0	10
1st year corn	rygr/clove	4600	4600	7800	1500	4630
2nd year corn	ryegrass	16900	1400	1500	2500	5580
continuous corn	rygr/clove	2900	650	10700	0	3560
rep means		4990	2530	6480	950	3740
FERTILIZER						
soybean	cover[1]	9500	200	10500	11200	7850
wheat	clover	0	0	0	0	0
1st year corn	rygr/clove	5200	50	6300	0	2890
2nd year corn	ryegrass	1300	100	2700	2000	1530
continuous corn	rygr/clove	1400	23200	1800	1500	6980
rep means		3480	4710	4260	2940	3850
rep means		4240	3620	5370	1950	3790

June 28- July 29, 1994		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		ml				
COMPOST						
soybean	cover[1]	0	250	1950	3750	1490
wheat	clover	150	0	200	0	90
1st year corn	rygr/clove	0	1750	150	2300	1050
2nd year corn	ryegrass	400	2200	0	5100	1930
continuous corn	rygr/clove	0	250	1800	2450	1130
rep means		110	890	820	2720	1140
FERTILIZER						
soybean	cover[1]	1600	650	700	500	860
wheat	clover	0	0	0	0	0
1st year corn	rygr/clove	9950	0	0	450	2600
2nd year corn	ryegrass	1500	350	200	150	550
continuous corn	rygr/clove	350	1900	0	300	640
rep means		2680	580	180	280	930
rep means		1400	740	500	1500	1030

Table G.4. (cont'd)

July 30- Aug. 29, 1994		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		ml				
COMPOST						
soybean	cover[1]	150	0	3500	0	910
wheat	clover	0	400	0	0	100
1st year corn	rygr/clove	0	0	0	0	0
2nd year corn	ryegrass	4500	6050	0	0	2640
continuous corn	rygr/clove	0	200	3350	0	890
rep means		930	1330	1370	0	910
FERTILIZER						
soybean	cover[1]	1150	0	0	100	310
wheat	clover	2050	950	0	0	750
1st year corn	rygr/clove	4700	0	400	5000	2530
2nd year corn	ryegrass	3850	0	0	0	960
continuous corn	rygr/clove	350	0	0	0	90
rep means		2420	190	80	1020	930
rep means		1680	760	730	510	920

Aug. 30- Oct. 21, 1994		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		ml				
COMPOST						
soybean	cover[1]	0	0	1050	3500	1140
wheat	clover	0	0	300	0	80
1st year corn	rygr/clove	0	0	550	2500	760
2nd year corn	ryegrass	450	300	300	700	440
continuous corn	rygr/clove	0	300	250	1500	510
rep means		90	120	490	1640	590
FERTILIZER						
soybean	cover[1]	0	0	700	300	250
wheat	clover	950	350	1000	0	580
1st year corn	rygr/clove	400	100	1000	400	480
2nd year corn	ryegrass	650	0	550	150	340
continuous corn	rygr/clove	700	1200	0	600	630
rep means		540	330	650	290	460
rep means		320	230	570	970	520

Table G.4. (cont'd)

Oct. 22- Dec. 5, 1994		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		ml				
COMPOST						
soybean	cover[1]	0	0	3650	400	1010
wheat	clover	0	1250	400	0	410
1st year corn	rygr/clove	5200	1150	1450	1300	2280
2nd year corn	ryegrass	850	7650	0	7500	4000
continuous corn	rygr/clove	100	0	1150	2000	810
rep means		1230	2010	1330	2240	1700
FERTILIZER						
soybean	cover[1]	1500	3500	2500	1500	2250
wheat	clover	1400	1600	1750	300	1260
1st year corn	rygr/clove	4500	100	5000	400	2500
2nd year corn	ryegrass	12900	0	1750	400	3760
continuous corn	rygr/clove	9300	800	1250	2650	3500
rep means		5920	1200	2450	1050	3650
rep means		3580	1600	1890	1650	2180

[1] soybean has no cover crop present, but designation shows plot history

Table G.5. Lysimeter leachate NO_3-N concentrations comparing compost and fertilizer treatments on each sampling date in 1994.

Dec.1, 1993- March 2, 1994		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		ppm in water				
COMPOST						
soybean	cover[1]	0.0	1.6	8.0	5.8	3.8
wheat	clover	90.4	89.6	23.9	0.0	51.0
1st year corn	rygr/clove	20.4	29.3	19.8	83.3	38.2
2nd year corn	ryegrass	5.8	17.6	13.0	3.0	9.9
continuous corn	rygr/clove	36.1	35.3	2.9	11.4	21.4
rep means		30.5	34.7	13.5	20.7	24.9
FERTILIZER						
soybean	cover[1]	24.5	81.8	7.2	25.0	34.6
wheat	clover	50.2	53.7	0.0	81.8	46.4
1st year corn	rygr/clove	6.9	26.8	3.5	147.7	46.2
2nd year corn	ryegrass	70.0	38.9	41.6	52.6	50.7
continuous corn	rygr/clove	35.9	71.1	72.5	32.6	53.0
rep means		37.5	54.4	25.0	67.9	46.2
rep means		34.0	44.6	19.2	44.3	35.5

March 3- April 4, 1994		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		ppm in water				
COMPOST						
soybean	cover[1]	0.0	1.1	5.0	4.7	2.7
wheat	clover	86.9	0.0	24.2	0.0	27.8
1st year corn	rygr/clove	12.9	13.9	16.6	55.4	24.7
2nd year corn	ryegrass	6.2	10.7	6.1	1.8	6.2
continuous corn	rygr/clove	12.2	23.5	3.7	9.0	12.1
rep means		23.6	9.8	11.1	14.2	14.7
FERTILIZER						
soybean	cover[1]	20.9	67.4	9.7	15.8	28.4
wheat	clover	50.1	55.4	0.0	0.0	26.4
1st year corn	rygr/clove	7.3	17.9	4.4	128.2	39.5
2nd year corn	ryegrass	42.3	38.3	14.7	51.6	36.7
continuous corn	rygr/clove	31.0	57.5	70.7	31.6	47.7
rep means		30.3	47.3	19.9	45.4	35.7
rep means		27.0	28.6	15.5	29.8	25.2

Table G.5. (cont'd)

April 5- June 27, 1994		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		----------ppm in water----------				
COMPOST						
soybean	cover[1]	27.3	5.7	12.8	10.3	14.0
wheat	clover	66.4	0.0	0.0	0.0	16.6
1st year corn	rygr/clove	16.0	2.1	27.5	37.6	20.8
2nd year corn	ryegrass	10.4	4.9	7.3	16.5	9.8
continuous corn	rygr/clove	11.7	17.1	8.6	0.0	9.4
rep means		26.3	6.0	11.2	12.9	14.1
FERTILIZER						
soybean	cover[1]	25.5	43.7	17.0	18.1	26.1
wheat	clover	0.0	0.0	0.0	0.0	0.0
1st year corn	rygr/clove	29.0	15.6	12.4	0.0	14.3
2nd year corn	ryegrass	34.6	39.5	9.1	45.9	32.2
continuous corn	rygr/clove	19.6	38.6	68.8	28.5	38.9
rep means		21.7	27.5	21.4	18.5	22.3
rep means		24.0	16.7	16.3	15.7	18.2

June 28- July 29, 1994		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		----------ppm in water----------				
COMPOST						
soybean	cover[1]	0.0	12.9	15.4	12.1	10.1
wheat	clover	70.7	0.0	24.4	0.0	23.8
1st year corn	rygr/clove	0.0	30.0	34.8	37.8	25.7
2nd year corn	ryegrass	11.0	6.2	0.0	3.9	5.3
continuous corn	rygr/clove	0.0	17.8	10.7	6.0	8.6
rep means		16.3	13.4	17.1	12.0	14.7
FERTILIZER						
soybean	cover[1]	26.2	43.0	19.9	22.8	28.0
wheat	clover	0.0	0.0	0.0	0.0	0.0
1st year corn	rygr/clove	31.3	0.0	0.0	60.0	22.8
2nd year corn	ryegrass	38.8	41.3	15.6	40.2	34.0
continuous corn	rygr/clove	18.6	29.3	0.0	33.2	20.3
rep means		23.0	22.7	7.1	31.2	21.0
rep means		19.7	18.0	12.1	21.6	17.8

Table G.5. (cont'd)

July 30- Aug. 29, 1994		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		ppm in water				
COMPOST						
soybean	cover[1]	21.8	0.0	7.6	0.0	7.4
wheat	clover	0.0	67.1	0.0	0.0	16.8
1st year corn	rygr/clove	0.0	0.0	0.0	0.0	0.0
2nd year corn	ryegrass	2.7	1.8	0.0	0.0	1.1
continuous corn	rygr/clove	0.0	17.2	1.6	0.0	4.7
rep means		4.9	17.2	1.8	0.0	6.0
FERTILIZER						
soybean	cover[1]	25.0	0.0	0.0	23.9	12.2
wheat	clover	30.2	9.6	0.0	0.0	10.0
1st year corn	rygr/clove	15.6	0.0	15.0	58.8	22.3
2nd year corn	ryegrass	45.3	0.0	0.0	0.0	11.3
continuous corn	rygr/clove	16.0	0.0	0.0	0.0	4.0
rep means		26.4	1.9	3.0	16.5	12.0
rep means		15.7	9.6	2.4	8.3	9.0

Aug. 30- Oct. 21, 1994		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		ppm in water				
COMPOST						
soybean	cover[1]	0.0	0.0	8.5	11.4	5.0
wheat	clover	0.0	0.0	17.6	0.0	4.4
1st year corn	rygr/clove	0.0	0.0	35.8	36.1	18.0
2nd year corn	ryegrass	3.5	2.5	10.5	5.5	5.5
continuous corn	rygr/clove	0.0	17.5	2.6	5.4	6.4
rep means		0.7	4.0	15.0	11.7	7.8
FERTILIZER						
soybean	cover[1]	0.0	0.0	21.0	22.9	11.0
wheat	clover	29.8	10.4	52.1	0.0	23.1
1st year corn	rygr/clove	20.8	15.6	13.0	62.2	27.9
2nd year corn	ryegrass	44.4	0.0	11.4	34.1	22.5
continuous corn	rygr/clove	19.6	24.0	0.0	30.2	18.4
rep means		22.9	10.0	19.5	29.9	20.6
rep means		11.8	7.0	17.3	20.8	14.2

Table G.5. (cont'd)

Oct. 22- Dec. 5, 1994		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		ppm in water				
COMPOST						
soybean	cover[1]	0.0	0.0	9.0	10.6	4.9
wheat	clover	0.0	47.3	14.9	0.0	15.5
1st year corn	rygr/clove	8.7	8.9	11.7	12.1	10.3
2nd year corn	ryegrass	2.2	1.0	0.0	1.9	1.3
continuous corn	rygr/clove	14.7	0.0	1.9	1.4	4.5
rep means		5.1	11.4	7.5	5.2	7.3
FERTILIZER						
soybean	cover[1]	27.1	26.8	20.1	23.6	24.4
wheat	clover	9.2	6.7	28.3	63.7	27.0
1st year corn	rygr/clove	16.9	17.5	2.7	73.5	27.6
2nd year corn	ryegrass	29.8	0.0	6.3	33.8	17.5
continuous corn	rygr/clove	2.5	16.1	61.0	9.0	22.2
rep means		17.1	13.4	23.7	40.7	23.7
rep means		11.1	12.4	15.6	23.0	15.5

[1] soybean has no cover crop present, but designation shows plot history

Table G.6. Calculated lysimeter NO_3-N leachate losses per acre comparing compost and fertilizer treatments on each sampling date in 1994.

Dec. 1, 1993- March 2, 1994		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		lbs NO_3-N/acre				
COMPOST						
soybean	cover[1]	0.0	4.5	5.7	4.5	3.7
wheat	clover	6.6	5.5	2.3	0.0	3.6
1st year corn	rygr/clove	12.0	21.9	16.0	50.9	25.2
2nd year corn	ryegrass	13.8	3.2	7.8	2.1	6.7
continuous corn	rygr/clove	31.8	7.1	3.9	1.0	11.0
rep means		12.8	8.4	7.2	11.7	10.0
FERTILIZER						
soybean	cover[1]	32.4	22.0	8.5	25.1	22.0
wheat	clover	4.9	1.3	0.0	24.0	7.6
1st year corn	rygr/clove	5.3	24.2	3.6	58.7	23.0
2nd year corn	ryegrass	80.4	1.9	28.5	11.6	30.6
continuous corn	rygr/clove	12.7	22.2	29.7	12.8	19.3
rep means		27.2	14.3	14.1	26.4	20.5
rep means		20.0	11.4	10.6	19.1	15.3

March 3- April 4, 1994		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		lbs NO_3-N/acre				
COMPOST						
soybean	cover[1]	0.0	3.2	5.3	2.1	2.6
wheat	clover	3.2	0.0	1.0	0.0	1.1
1st year corn	rygr/clove	3.8	3.4	4.9	19.7	7.9
2nd year corn	ryegrass	5.5	1.2	1.4	0.6	2.2
continuous corn	rygr/clove	1.3	0.6	2.1	1.1	1.3
rep means		2.8	1.7	2.9	4.7	3.0
FERTILIZER						
soybean	cover[1]	11.0	3.7	4.4	4.8	6.0
wheat	clover	0.6	1.4	0.0	0.0	0.5
1st year corn	rygr/clove	5.3	6.0	0.3	37.6	12.3
2nd year corn	ryegrass	24.3	2.8	7.0	9.5	10.9
continuous corn	rygr/clove	6.4	22.9	21.6	5.8	14.2
rep means		9.5	7.4	6.7	11.5	8.8
rep means		6.1	4.5	4.8	8.1	5.9

Table G.6. (cont'd)

April 5- June 27, 1994		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		lbs NO_3-N/acre				
COMPOST						
soybean	cover[1]	1.7	4.2	20.2	0.9	6.8
wheat	clover	0.4	0.0	0.0	0.0	0.1
1st year corn	rygr/clove	9.0	1.2	26.2	6.9	10.8
2nd year corn	ryegrass	21.5	0.8	1.4	5.1	7.2
continuous corn	rygr/clove	4.2	1.4	11.3	0.0	4.2
rep means		7.3	1.5	11.8	2.6	5.8
FERTILIZER						
soybean	cover[1]	29.7	19.8	25.2	24.9	24.9
wheat	clover	0.0	0.0	0.0	0.0	0.0
1st year corn	rygr/clove	18.5	3.3	9.6	0.0	7.8
2nd year corn	ryegrass	18.2	2.9	3.0	11.2	8.8
continuous corn	rygr/clove	3.4	13.7	15.1	5.2	9.4
rep means		13.9	7.9	10.6	8.3	10.2
rep means		10.6	4.7	11.2	5.4	8.0

June 28- July 29, 1994		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		lbs NO_3-N/acre				
COMPOST						
soybean	cover[1]	0.0	0.4	3.7	5.6	2.4
wheat	clover	1.3	0.0	0.6	0.0	0.5
1st year corn	rygr/clove	0.0	6.4	0.6	10.6	4.4
2nd year corn	ryegrass	0.5	1.7	0.0	2.4	1.2
continuous corn	rygr/clove	0.0	0.6	2.4	1.8	1.2
rep means		0.4	1.8	1.5	4.1	1.9
FERTILIZER						
soybean	cover[1]	5.1	3.4	1.7	1.4	2.9
wheat	clover	0.0	0.0	0.0	0.0	0.0
1st year corn	rygr/clove	38.1	0.0	0.0	1.5	9.9
2nd year corn	ryegrass	7.1	1.8	0.4	0.7	2.5
continuous corn	rygr/clove	0.8	6.8	0.0	1.8	2.4
rep means		10.2	2.4	0.4	1.1	3.5
rep means		5.3	2.1	0.9	2.6	2.7

Table G.6. (cont'd)

July 30- Aug. 29, 1994		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		----------lbs NO_3-N/acre----------				
COMPOST						
soybean	cover[1]	0.4	0.0	3.2	0.0	0.9
wheat	clover	0.0	3.3	0.0	0.0	0.8
1st year corn	rygr/clove	0.0	0.0	0.0	0.0	0.0
2nd year corn	ryegrass	1.5	1.3	0.0	0.0	0.7
continuous corn	rygr/clove	0.0	0.4	0.7	0.0	0.3
rep means		0.4	1.0	0.8	0.0	0.5
FERTILIZER						
soybean	cover[1]	3.5	0.0	0.0	0.3	1.0
wheat	clover	7.6	1.1	0.0	0.0	2.2
1st year corn	rygr/clove	8.9	0.0	0.7	36.0	11.4
2nd year corn	ryegrass	21.3	0.0	0.0	0.0	5.3
continuous corn	rygr/clove	0.7	0.0	0.0	0.0	0.2
rep means		8.4	0.2	0.1	7.3	4.0
rep means		4.4	0.6	0.5	3.6	2.3

Aug. 30- Oct. 21, 1994		PLOT				
TREATMENT	COVER	REP 1	REP 2	REP 3	REP 4	MEAN
		----------lbs NO_3-N/acre----------				
COMPOST						
soybean	cover[1]	0.0	0.0	1.1	4.9	1.5
wheat	clover	0.0	0.0	0.7	0.0	0.2
1st year corn	rygr/clove	0.0	0.0	2.4	11.0	3.4
2nd year corn	ryegrass	0.2	0.1	0.4	0.5	0.3
continuous corn	rygr/clove	0.0	0.6	0.1	1.0	0.4
rep means		0.0	0.1	0.9	3.5	1.1
FERTILIZER						
soybean	cover[1]	0.0	0.0	1.8	0.8	0.7
wheat	clover	3.5	0.4	6.4	0.0	2.6
1st year corn	rygr/clove	1.0	0.2	1.6	3.0	1.5
2nd year corn	ryegrass	3.5	0.0	0.8	0.6	1.2
continuous corn	rygr/clove	1.7	3.5	0.0	2.2	1.9
rep means		1.9	0.8	2.1	1.3	1.6
rep means		1.0	0.5	1.5	2.4	1.3

Table G.6. (cont'd)

Oct. 22- Dec. 5, 1994		PLOT				
TREATMENT	**COVER**	**REP 1**	**REP 2**	**REP 3**	**REP 4**	**MEAN**
		----------lbs NO_3-N/acre----------				
COMPOST						
soybean	cover[1]	0.0	0.0	4.0	0.5	1.1
wheat	clover	0.0	7.2	0.7	0.0	2.0
1st year corn	rygr/clove	5.5	1.3	2.1	1.9	2.7
2nd year corn	ryegrass	0.2	1.0	0.0	1.7	0.7
continuous corn	rygr/clove	0.2	0.0	0.3	0.4	0.2
rep means		1.2	1.9	1.4	0.9	1.3
FERTILIZER						
soybean	cover[1]	5.0	11.5	6.1	4.3	6.7
wheat	clover	1.6	1.3	6.1	2.3	2.8
1st year corn	rygr/clove	9.3	0.2	1.6	3.6	3.7
2nd year corn	ryegrass	47.0	0.0	1.3	1.7	12.5
continuous corn	rygr/clove	2.9	1.6	9.3	2.9	4.2
rep means		13.1	2.9	4.9	3.0	6.0
rep means		7.2	2.4	3.2	1.9	3.7

[1] soybean has no cover crop present, but designation shows plot history

Appendix H

Graphs

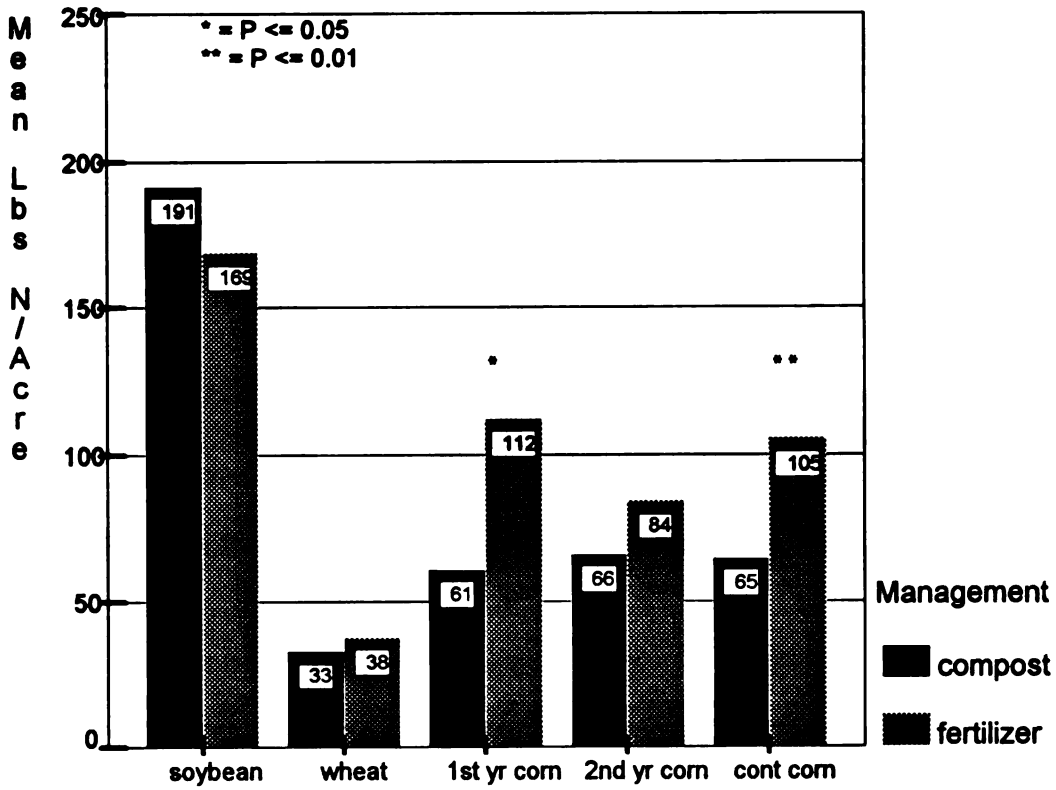

Figure H.1. Crop above-ground biomass N in 1993.

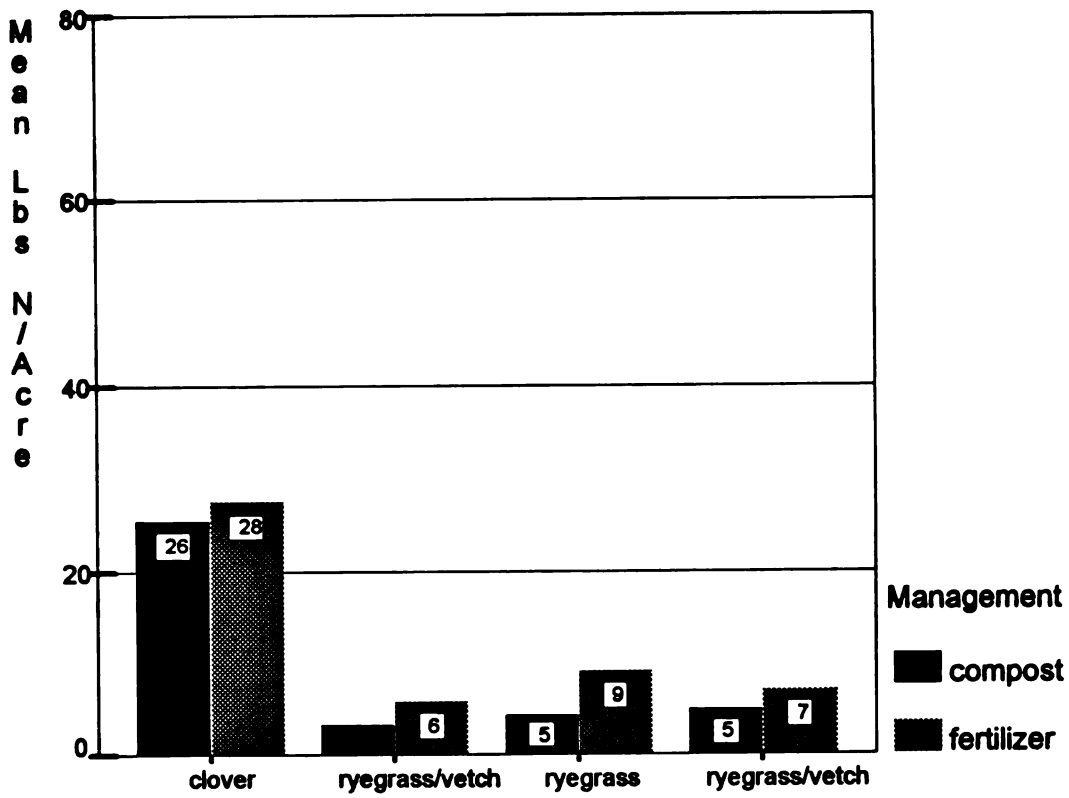

Figure H.2. Cover crop above-ground biomass N in 1993.

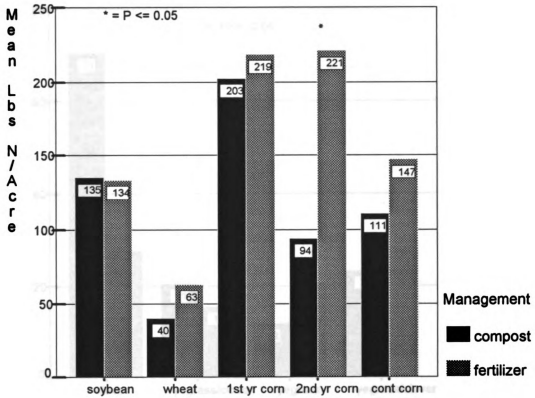

Figure H.3. Crop above-ground biomass N in 1994.

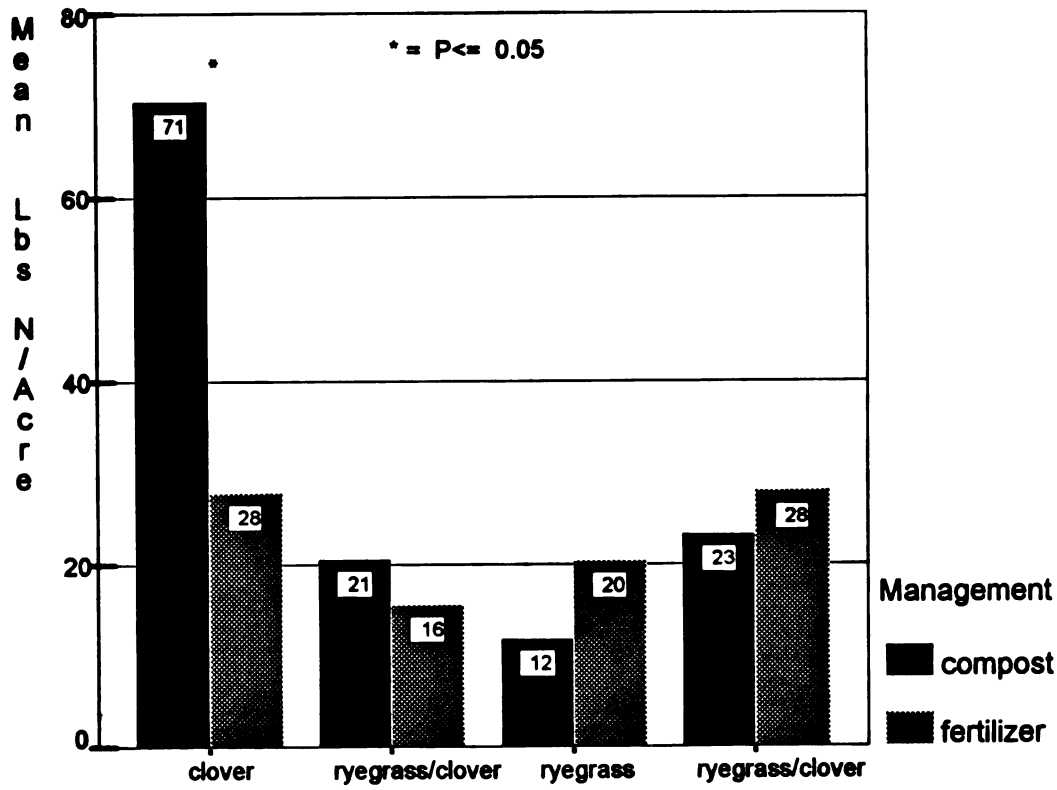

Figure H. 4. Cover crop above-ground biomass N in 1994.

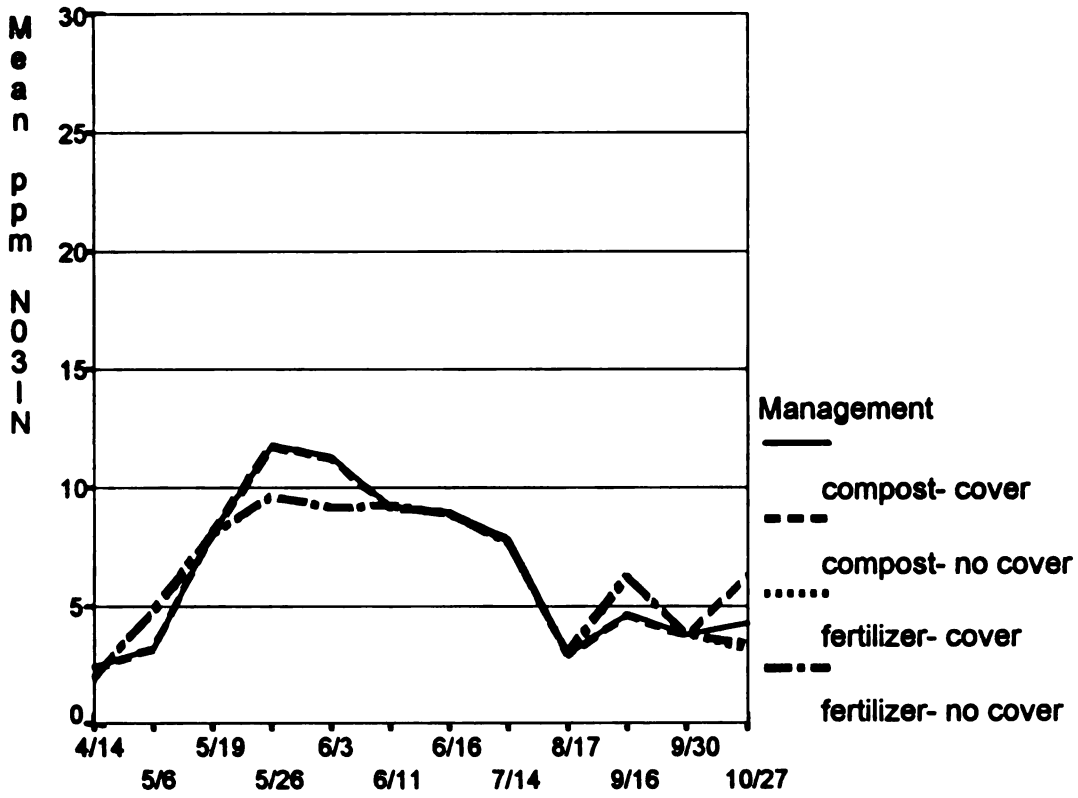

Figure H.5. Soil NO3-N of soybean in 1993.

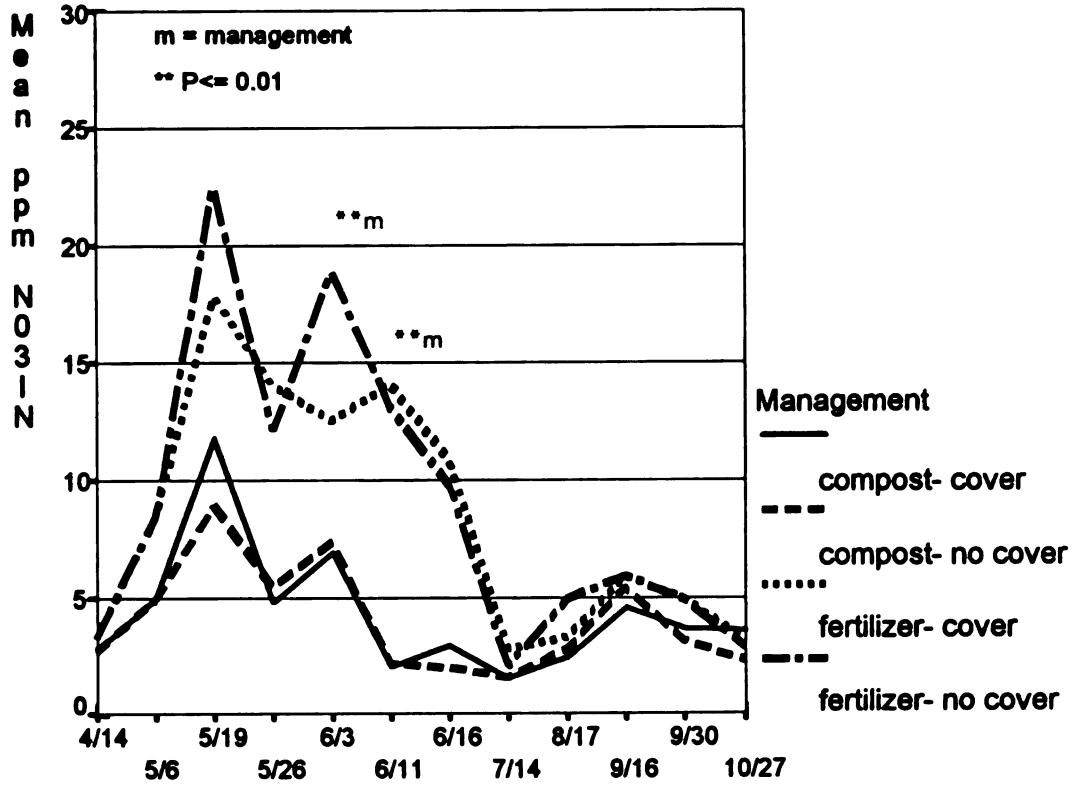

Figure H.6. Soil NO3-N of wheat with clover in 1993.

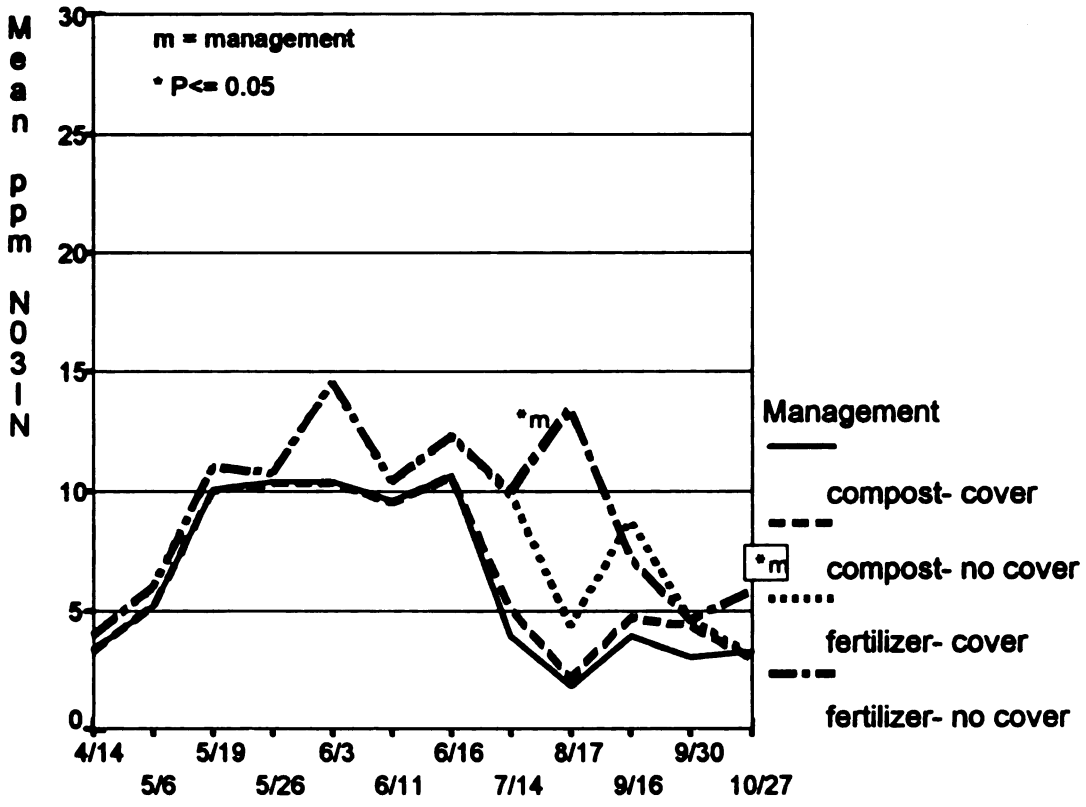

Figure H.7. Soil NO3-N of 1st yr corn with ryegrass/vetch in 1993.

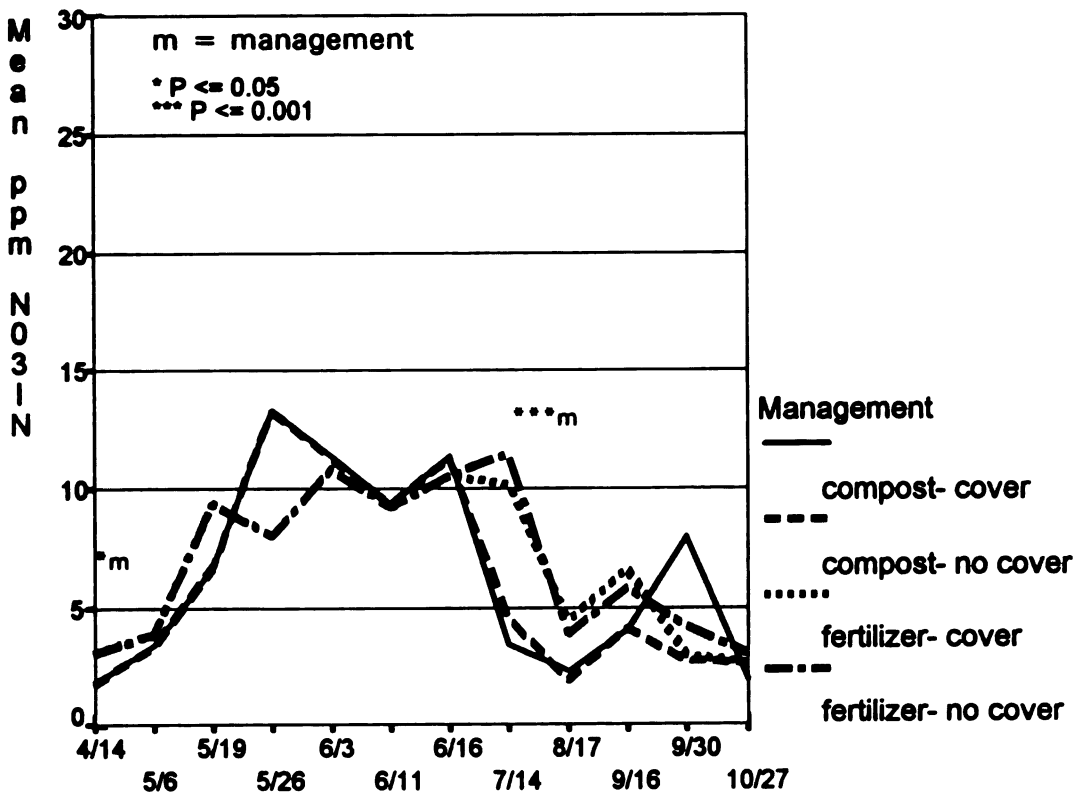

Figure H.8. Soil NO3-N of 2nd yr corn with ryegrass in 1993.

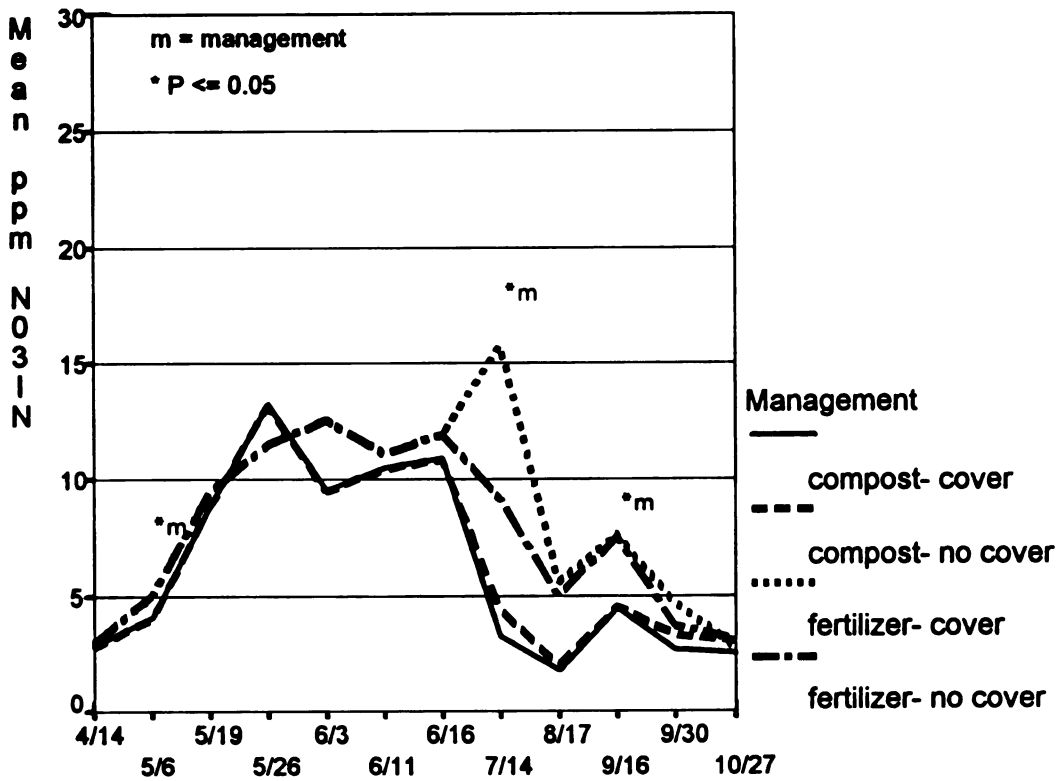

Figure H.9. Soil NO3-N of continuous corn with ryegrass/vetch in 1993.

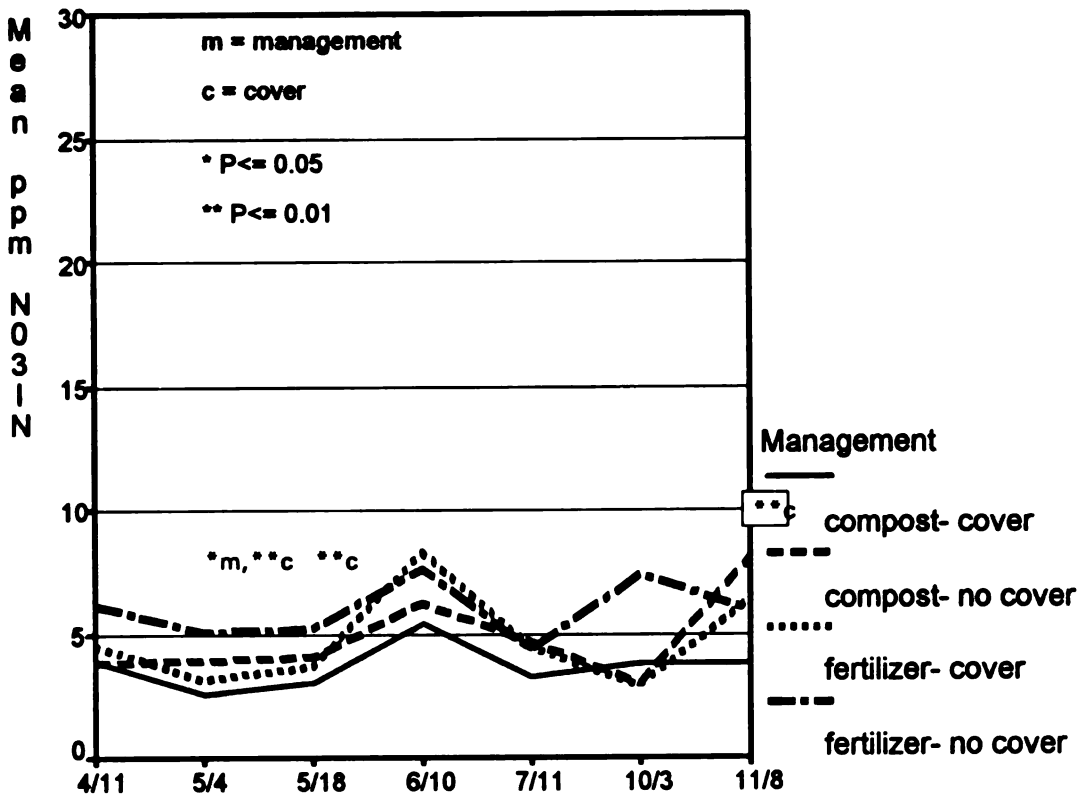

Figure H.10. Soil NO3-N of soybean in 1994.

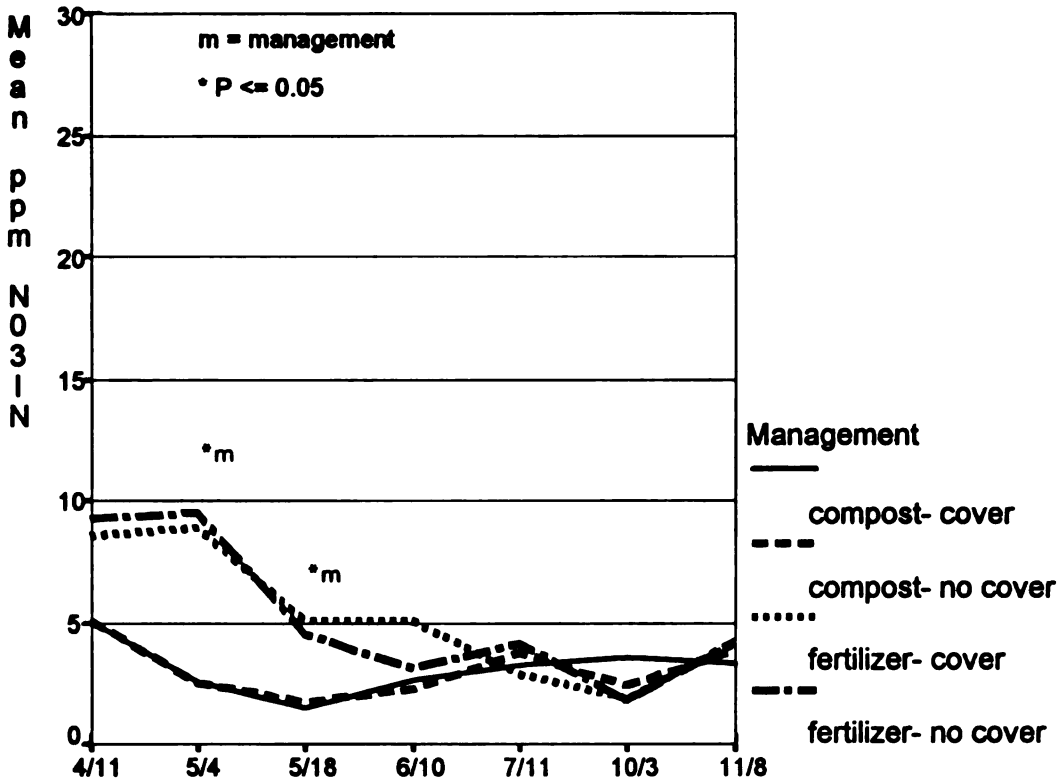

Figure H.11. Soil NO3-N of wheat with clover in 1994.

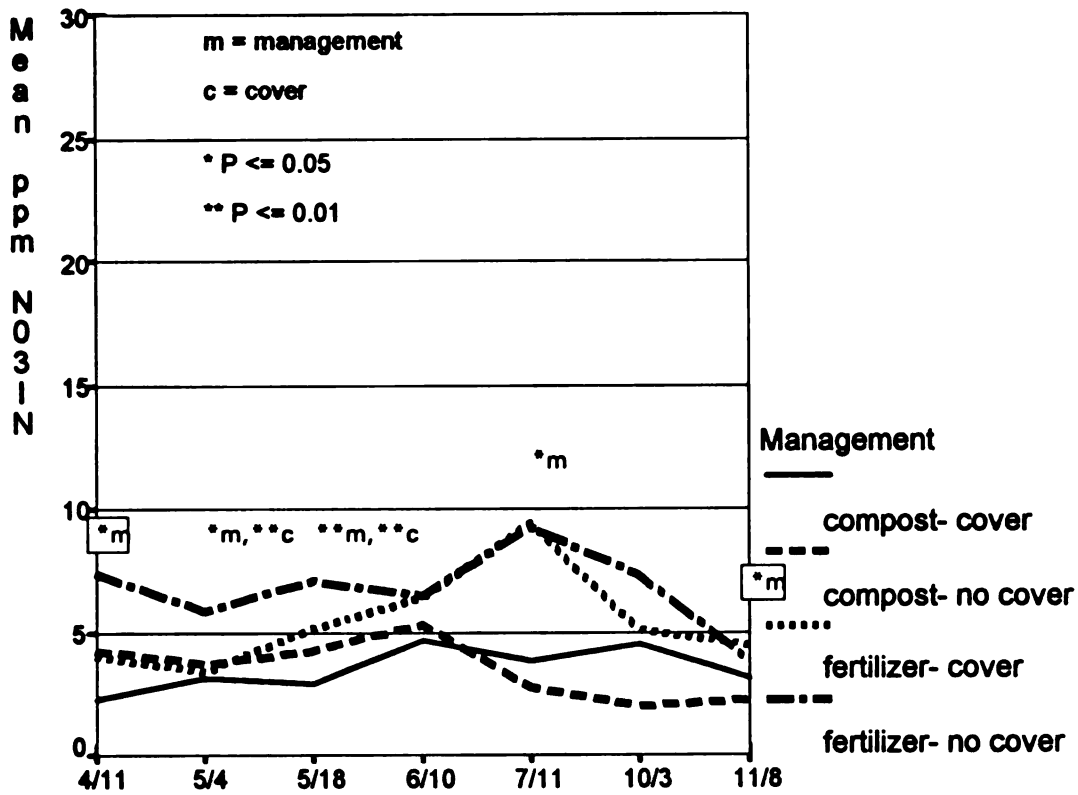

Figure H.12. Soil NO3-N of 2nd yr corn with ryegrass in 1994.

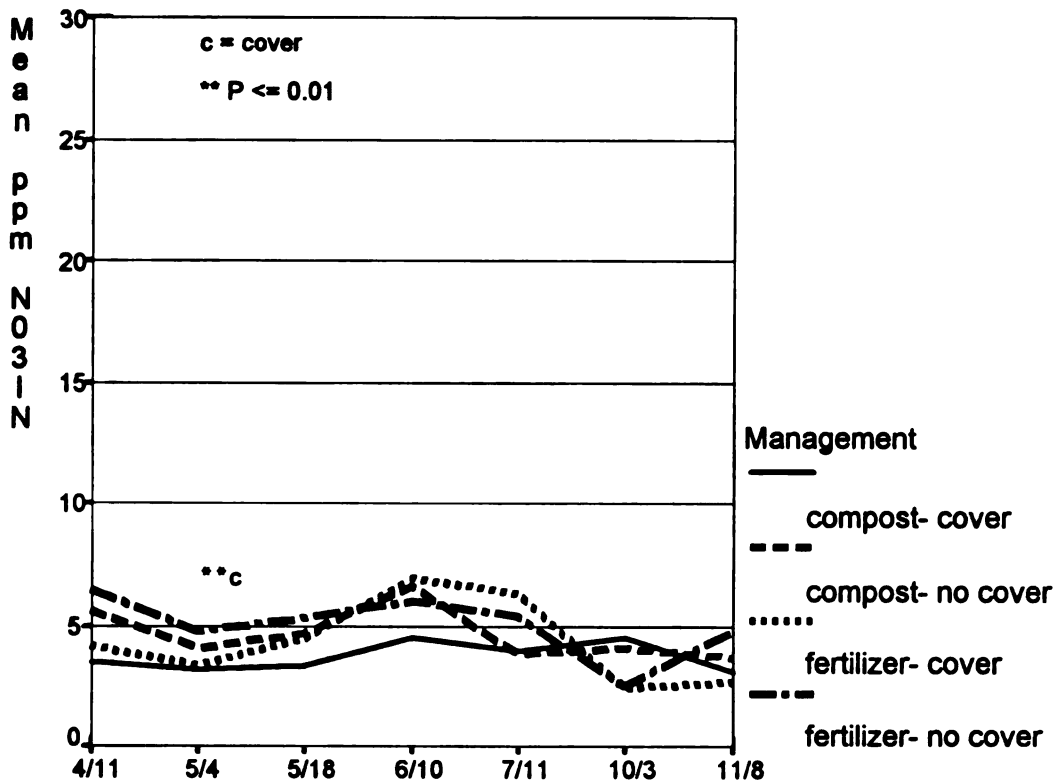

Figure H.13. Soil NO3-N of continuous corn with ryegrass/clover in 1994.

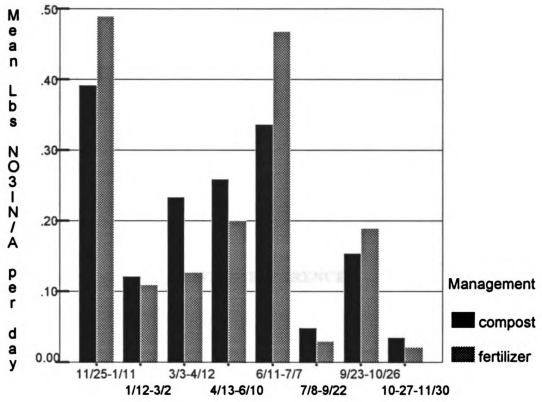

Figure H.14. 1993 lysimeter NO3-N as daily mean per time period.

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