United States
Environmental Protection
Agency

Environmental Research
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EPA-600/3-78-056
May 1978

Research and Development

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Transport of Agricultural Chemicals From Small Upland Piedmont Watersheds

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EPA-600/3-78-056
May 1978

TRANSPORT OF AGRICULTURAL CHEMICALS

FROM SMALL UPLAND PIEDMONT WATERSHEDS

by

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Contract Number IAG-D6-0381

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DISCLAIMER

This joint report has been reviewed by the Athens Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, and the Southern Piedmont Conservation Research Center, Science and Education Administration, U.S. Department of Agriculture, and approved for publication.

On 24 January 1978, four USDA agencies--Agricultural Research Service (ARS), Cooperative State Research Service (CSRS), Extension Service (ES), and the National Agricultural Library (NAL)--merged to become a new organization, the Science and Education Administration (SEA), U.S. Department of Agriculture.

This publication was prepared by the U.S. Environmental Protection Agency and the Science and Education Administration's Federal Research staff, which was formerly the Agricultural Research Service.

This paper reports the results of research only. Mention of a pesticide in this paper does not constitute a recommendation for use by the U.S. Department of Agriculture or the U.S. Environmental Protection Agency nor does it imply registration under FIFRA, as amended.

Mention of trade names or commercial products is for informational purposes only and does not constitute endorsement or preferential treatment by USDA or EPA.

FOREWORD

Environmental protection efforts are increasingly directed towards preventing adverse health and ecological effects associated with specific compounds of natural or human origin. As part of the Athens Environmental Research Laboratory's research and development on the occurrence, movement, transformation, impact, and control of environmental contaminants, the Technology Development and Applications Branch develops management and engineering tools for assessing and controlling adverse environmental effects of non-irrigated agriculture and of silviculture.

The Southern Piedmont Conservation Research Center, USDA-SEA, began as a soil erosion research station in 1939. It's research objectives since that time have been development of technology for the protection and utilization of the Region's soil and water resources in productive agricultural systems. Movement of agricultural chemicals in surface runoff has been studied since 1960.

Because of mutual concerns and complementary capabilities, the two laboratories began cooperative research in 1970.

This joint report, which fulfills the requirements of Interagency Support Agreement Number D6-0381, is designed for use in the development and testing of mathematical models for predicting the movement and behavior of agricultural chemicals from land applications under various watershed management systems. Included in the report is a discussion of the four watershed systems, the instrumentation used, the experimental design, and the watershed management approach along with a summary of the data collected during a four-year study period.

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ABSTRACT

This project, a joint effort of the U.S. Environmental Protection Agency and the U.S. Department of Agriculture, was designed to provide a data base for the conceptual development and testing of operational models for describing pesticide and nutrient transport from agricultural lands. Data were collected from four small watersheds (1.3 to 2.7 hectares) located in the Southern Piedmont physiographic region. Two watersheds were managed without conservation measures; the other two watersheds were parallel-terraced and included grassed waterways for soil erosion control. All sites were row-cropped to either soybeans, corn, or grain sorghum. Winter cover crops of rye and barley were established on the well-managed watersheds. This report discusses the experimental procedures used, presents a general interpretation of the various data and provides a data summary.

Total losses of applied herbicides were affected by the occurrence of runoff in close proximity to application date, mode of application, and persistence in the soil runoff zone. Most of the total losses in runoff were in the first three runoff events for all compounds except paraquat. Runoff of trifluralin, a soil-incorporated herbicide, was very low, 0.1 to 0.3 percent of the annual application. Total runoff losses of the other herbicides were commonly less than 1.0 percent except when runoff occurred shortly after application and then runoff losses exceeded 5 percent. Paraquat served as a useful tracer for sediment-transported materials.

Sediment yield from terraced watersheds was significantly less than from watersheds managed without terraces. Except for paraquat, however, pesticide yields in runoff were not reduced in proportion to sediment reduction because solution transport was the major mode of loss for the soluble herbicide phase.

Surface runoff losses of soluble plant nutrients were low and similar in magnitude from terraced and non-terraced watersheds. Annual losses were about 5.0 and 1.3 kg/ha for chloride and nitrate, respectively.

Precipitation annually contributed 6.0 and 3.2 kilograms per hectare (kg/ha) chloride and nitrate, respectively, to the watersheds.

Over the study period for the nutrient loss phase of the project (16 months, spanning two growing seasons and one winter), 16 and 7.5 kg/ha of total Kjeldahl nitrogen appeared in runoff from a non-terraced and terraced watershed. Total sediment phosphorus yields from the terraced and non-terraced watershed were 1.7 and 6.0 kg/ha, respectively, reflecting differences in sediment yield.

Losses of soluble phosphorus from both watersheds were very low, about 380 grams per hectare (g/ha) over the study period. Solution concentrations were generally about 0.1 milligrams per liter (mg/liter), ranging upward to about 0.4 mg/liter. Variation in solution concentrations were not, however, related to suspended sediment concentrations.

This report was submitted in fulfillment of an Interagency Agreement, Number D6-0381, between the U.S. Environmental Protection Agency, Environmental Research Laboratory, Athens, GA, and the U.S. Department of Agriculture, Science and Education Administration, Southern Piedmont Conservation Research Center, Watkinsville, GA. Work was completed as of July 1976.

CONTENTS

FIGURES

List of Figures (continued)

List of Figures (continued)

List of Figures (continued)

List of Figures (continued)

TABLES

List of Tables (continued)

List of Tables (continued)

List of Tables (continued)

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ACKNOWLEDGMENTS

Successful completion of a project of this magnitude required the expertise of a multidisciplinary team of individuals and the close cooperation of two independent Federal agencies. That the project succeeded so well is a tribute to all those involved. Although the names of all the individual contributors are too numerous to mention here without the possibility of omission, their efforts are gratefully acknowledged. Special recognition, however, must be accorded to the initial Project Officer, Dr. H. P. Nicholson, who was instrumental in initiating this research project. The following team members contributed to this project and report:

Southern Piedmont Conservation Research Center (SPCRC)

A. P. Barnett, Agricultural Engineer - Watershed instrumentation, consultation on runoff and soil erosion.

R. R. Bruce, Soil Scientist - Characterization of soil-water regimes, expertise in soil physical properties and behavior.

J. W. Ellis, Engineering Technician - Hydrologic equipment design, fabrication, and maintenance; hydrologic data tabulation and management.

W. G. Fleming, Agricultural Research Technician - Data management and reduction; soil and sediment characterization and analysis.

D. M. Hildreth, Biological Science Technician - Plant nutrient analyses.

W. A. Jackson, Research Chemist - Chemical analyses of plant nutrients in soil, sediment, and water.

A. D. Lovell, Physical Science Technician - Determination of soil-water regimes.

A. W. Thomas, Agricultural Engineer - Hydrologic data handling and interpretation.

J. W. Turnbull, Physical Science Technician - Plant nutrient analyses.

Athens Environmental Research Laboratory (ERL)

J. E. Benner, Research Physical Science Technician - Pesticide analysis in soil, sediment, and water.

D. S. Brown, Research Soil Scientist - Initial data processing; expertise in adsorption/desorption properties.

A. Burks, Soil Scientist - Field sampling and determination of soil-water content.

D. M. Cline, Computer Systems Analyst - Computer software development, data processing, and development of data management system.

T. W. Culbertson, Engineering Technician - Determination of soil-water regimes and sampling pesticide residue.

S. W. Karickhoff, Research Chemist Initial data processing; consultation on pesticide runoff and persistence.

W. R. Payne, Jr., Research Chemist Pesticide analyses in soil, sediment, and water.

J. D. Pope, Research Chemist Pesticide analyses in soil, sediment, and water.

W. C. Steen, Research Soil Scientist - Initial data processing; consultation on pesticide degradation.

A. L. Warner, Secretary Typing and graphical support.

Special recognition on data handling and processing - F. O. Burchfield, W. M. Leard, C. R. Mackert, J. L. Malanchuk, and B. F. Taylor.

SECTION 1

INTRODUCTION

Agricultural chemicals have been and will probably remain vital weapons in man's arsenal for combatting pests and plant diseases that would hinder production of the food and fiber needed by an ever increasing population. Recently, however, concern has increased that these toxic chemicals, particularly pesticides, are transported from the site of application -- dissolved in water runoff from the land surface or bound on eroded soil particles as they are carried in overland flow to receiving waters -- to become pollution problems.

Through laboratory and *in vitro* experiments, much has been learned over the past several years concerning the fate and behavior of a variety of pesticides in soil systems. In most of this work, a specific mechanism of adsorption or pathway of degradation was examined. Little has been done at the field watershed level, however, with the purpose of developing mathematical models to predict and simulate pesticide movement and define those edaphic, climatic, pesticidal, and cultural factors that govern or influence the runoff, transport, movement, and degradation of pesticides. Although many pesticide runoff experiments have been conducted, they have, in most cases, collected insufficient data on all the factors affecting runoff that are necessary for developing and testing mathematical models of the combined processes.

A data collection problem of this magnitude requires a multidisciplinary approach, a high level of resources, and a commitment of staff over a rather long period of time. In recognition of this, two Federal agencies interested in environmental quality and having the necessary expertise began a joint research effort in 1971. The U.S. Environmental Protection Agency's Environmental Research Laboratory in Athens, GA, contributed its capabilities in areas of soil pesticide chemistry and interaction, residue analysis, and systems analysis and computer science; the U.S. Department of Agriculture's Southern Piedmont Conservation Research Center, Watkinsville, GA, added its expertise in the area of pesticide chemistry and interaction, hydrology, runoff and erosion, soils, crops, land management systems, and interpretation of field findings on an applied scale.

As the project began, the specific objectives were to measure the persistence of specific pesticides as influenced by selected chemical formulation and application factors, soil composition, and climatic conditions, and to measure pesticide losses in runoff from small watersheds and relate these losses to soil and pesticidal properties, formulations, application technologies, and associated hydrologic, soil erosion, and management factors. When additional resources became available in 1974, the project staff added parallel objectives involving the measurement of nitrogen and phosphorus movement in and transport from two field-size watersheds in which selected crop and land management practices were used in order to relate runoff losses to hydrologic and soil erosion factors and the assessment of the impact of nitrogen in rainfall on the overall nitrogen budget of the watershed as well as its contribution to nitrogen inputs to runoff.

The purpose of this report was to assemble the research findings in a form that could be readily used in further development and testing of mathematical models that describe pesticide and plant nutrient runoff. In fact, several models have already been developed using data from this study.[1-4] Additional progress in model development and testing will be made by the participants in this project and others using these results.

The SPCRC, in addition, conducted a study in 1973 and 1974 on trifluralin volatilization from one watershed, the results of which have been published.[5-7]

This cooperative approach to research first proved successful in an earlier study evaluating the amount of herbicide lost from small plots using a rainfall simulator.[8] The study reported here allowed scientists from both organizations to continue an examination of the persistence and degradation of pesticides in soil, a research area of interest since 1959.

The originator and initial Project Officer for EPA was Dr. H. P. Nicholson of the Athens ERL. The entire staff of the Agro-Environmental Systems Branch of the Athens ERL and the Agricultural Chemical Transport and Modeling Unit of the SPCRC were intimately involved in the project, with Dr. G. W. Bailey, Supervisory Research Chemist at the Athens ERL, and Dr. R. A. Leonard, Supervisory Soil Scientist at the SPCRC, serving as project leaders.

SECTION 2

CONCLUSIONS

- Concentrations of herbicides found in runoff water ranged from 0 to 26 milligrams per liter (mg/liter); concentrations found in sediment, ranged from 0 to 1,470 mg/kilogram. However, for all compounds except paraquat -- that is, diphenamid, trifluralin, atrazine, cyanazine, and 2,4-D -- the total herbicide mass transported in water was much greater than the mass transported by sediment.

- Herbicide concentrations in runoff were highest in the first runoff events occurring after application and decreased exponentially with time thereafter. Most of the total seasonal losses in runoff were in the first three events for all compounds. In some cases, however, the first event accounts for the total seasonal loss.

- Total seasonal losses of applied herbicides were affected by the occurrence of runoff in close proximity to application date, mode of application, and persistence in the soil runoff zone. Runoff of trifluralin, a soil-incorporated herbicide, was very low, 0.1 to 0.3 percent of the annual application. Total runoff losses of the other hebicides were commonly less than 3.0 percent except when large volumes of runoff occurred shortly after application. In these instances, runoff losses for diphenamid and propazine exceeded 5 percent of the application.

- Paraquat served as a useful tracer for sediment transported materials. As applied in this study, that is, to the soil surface immediately after planting, runoff losses commonly exceeded 5 percent of the application. In practice, however, paraquat is only applied to foliage as a contact herbicide; therefore, paraquat runoff losses of this study do not represent the range of losses expected from normal use.

- Of the procedures employed, actual herbicide application rates applied to experimental watersheds were best monitored using a large number of filter discs positioned to intercept the pesticide spray at selected points on the soil surface. However, results from the 1975 cropping season showed close agreement with that of the filter disc by using a surface soil sampler and nozzle discharge (timing) methods.

- In sampling soil for herbicide residues throughout the cropping season, two sampling methods were required. A surface soil sampler provided satisfactory results for sampling the loosely structured 2.5-centimeter (cm) surface soil from application day until the first runoff event occurred. This sampler eliminated the problems associated with using soil bulk density values. The split tube sampler performed well after the first runoff event when soil settling and compaction had taken place.

- Persistence of herbicides at the soil surface (0 to 1 cm zone) could be approximated by an exponential or pseudo-first-order decay curve, thus accounting for the observed exponential decrease in runoff with time. A break in the disappearance rate was observed for atrazine, diphenamid, and propazine after the first rainfall event. This "break" in decay rate with rainfall was not detected for paraquat or cyanazine. Separate first-order rate equations may be used to treat pre- and post-rain behavior.

- Herbicide persistence varied among years and between watersheds as affected by herbicide properties, mode of application, watershed management practices, and runoff events that occur in close proximity to application. Paraquat was the most persistent of the compounds studied. Ranges of computed half-lives ($t_{1/2}$) are: diphenamid, 1.3 to 4.0; trifluralin, 2.6 to 14.7; cyanazine, 2.9 to 4.7; atrazine, 2.4 to 5.1; paraquat, 6.8 to 34.6; and propazine, 7.5 days.

- Sediment yield from the terraced watersheds (P3 and P4) was significantly less than from the watersheds managed without terraces. Except for paraquat, however, pesticide yields in runoff were not reduced in proportion to sediment reduction. This was because the major mode of transport for the incompletely adsorbed herbicides was in the solution phase.

- Surface runoff losses of soluble plant nutrients were similar in magnitude from the non-terraced watershed P2 and the terraced watershed P4. Yield of various nutrients from watersheds P2 and P4, respectively, were: chloride, 13.8 and 10.4; ammonium-nitrogen, 4.2 and 1.8; total Kjeldahl nitrogen (TKN), 16 and 7.5; total-P (in sediment), 6.0 and 1.7 kilograms per hectare (kg/ha). The difference in yield is attributed to the amount of sediment loss for the two watershed management systems. In comparison, the sediment loss from the two watersheds were in approximate proportion to the TKN values. However, about one-third and one-half of the TKN was transported in solution from the non-terraced and the terraced watersheds, respectively. The higher proportion of solution TKN from the terraced watershed was derived from a single storm occurring shortly after application of a urea-ammonia fertilizer solution.

- Runoff losses of soluble phosphorus from both watersheds were about 350 grams per hectare (g/ha) over the study period. Solution concentrations were generally about 0.1 milligrams per liter (mg/liter), ranging upward to about 0.4 mg/liter on occasion. Variations in solution concentrations were not, however, related to suspended sediment concentrations.

- Precipitation contributed annually 6.0 and 3.2 kg/ha of chloride and nitrate, respectively, to the watersheds. Because of the timing of fertilizer applications in relation to rainfall-runoff distribution, considerable quantities of the chloride in runoff could have been derived from the fertilizer source, but little of the nitrate in runoff came from any single fertilizer application compared with that from other sources, including rainfall.

SECTION 3

RECOMMENDATIONS

A data base was established to develop and test mathematical models from which predictions can be made for nonpoint source loadings to streams from small watersheds in selected management systems. To better assess the problems of agricultural chemical transport, in general, the following suggestions are offered:

- This study dealt entirely with soil applied herbicides. Pesticide runoff should be investigated in more detail from no-till production systems. Runoff of micro-encapsulated and slow release pesticides should also be initiated. The runoff behavior of foliar applied compounds such as insecticides should also be better defined. Information is needed on plant interception and uptake and degradation, as well as on runoff.

- Basic research should be conducted to develop better understanding of pesticide partitioning between water and sediment, particularly to understand how partitioning changes with time in the natural soil system in relation to "bound residues" or non-singular adsorption-desorption. Also, how redistribution, if any, occurs during an individual event and during the runoff process.

- The intra-runoff event dynamics should be elucidated with regard to (1) particle size distribution, (2) sediment delivery, and (3) pesticide partitioning between water, inorganic, and organic soil particles at the watershed exit.

- Runoff values reported herein are measurements at the source. Additional research should be conducted to allow proper routing of pesticide in runoff to stream or bodies of water of significance.

- In order to develop adequate models of soluble nutrient transport, particularly nitrogen, subsurface hydrology and material transport needs to be better understood from a soils, geology, and physiographic landscape viewpoint.

- Additional models should define and describe the transport of pesticides from the edge of the field throughout the entire basin. This would permit using the data base generated here as source terms for basin-scale models.

- Better data management systems should be designed for acquisition and computation of hydrologic sediment and chemical data.

SECTION 4

THE EXPERIMENTAL SYSTEM

The watersheds and experimental areas for this study were located at the Southern Piedmont Conservation Research Center near Watkinsville, GA. The Southern Piedmont physiographic region, which covers an area of 59,000 square miles, extends from Virginia through North Carolina, South Carolina, and Georgia into Alabama and lies between the southern Appalachian Mountains to the west and the Southern Coastal Plains to the east (Figure 1).[9] Elevation above sea level ranges from about 90 meters in the east to 300 meters at the western boundary. The Southern Piedmont is underlain mostly by schists, gneisses, and granites with some basic rocks, but several narrow belts of sandstones and slates also are present. The topography is gently rolling with local relief varying from 3 to 60 meters.

Average annual temperature in the Southern Piedmont ranges from 14 to 18 °C. Average annual precipitation is 115 to 140 cm evenly distributed throughout the year. Heavy rainstorms or thunderstorms are more frequent in summer months resulting in higher rates of surface runoff and soil erosion during these months. Short periods of drought are also common during the growing season.

Groundwater supplies in the Piedmont are small and the major sources of water for municipal, industrial, and agricultural use are perennial streams, impoundments, and rainfall.

Traditionally, the Southern Piedmont has had a cash crop agriculture; cotton being the major cash crop of historical importance although tobacco has been important in the northern third of the area. Corn, grain sorghum, small grains, soybeans, and hay also have been important crops. Land in row crop agriculture has decreased significantly with concurrent increases in forests, forages, pastures, and livestock/poultry production. Urbanization has also claimed croplands. Relatively little Class I land is available for crop production. The concept of land capability class is described in most soil survey reports.[10] Class I land has few limitations that restrict its use. Class II, III, and IV land requires conservation practices for control of soil erosion. For example, parallel contour terraces, grassed waterways, strip cropping, sod rotations, and no-till planting may be adopted as needed to control erosion.

The Southern Piedmont Conservation Research Center is located on two tracts of land approximately 2 kilometers (km) apart. Four previously ungauged single-field watersheds were selected for this study and were

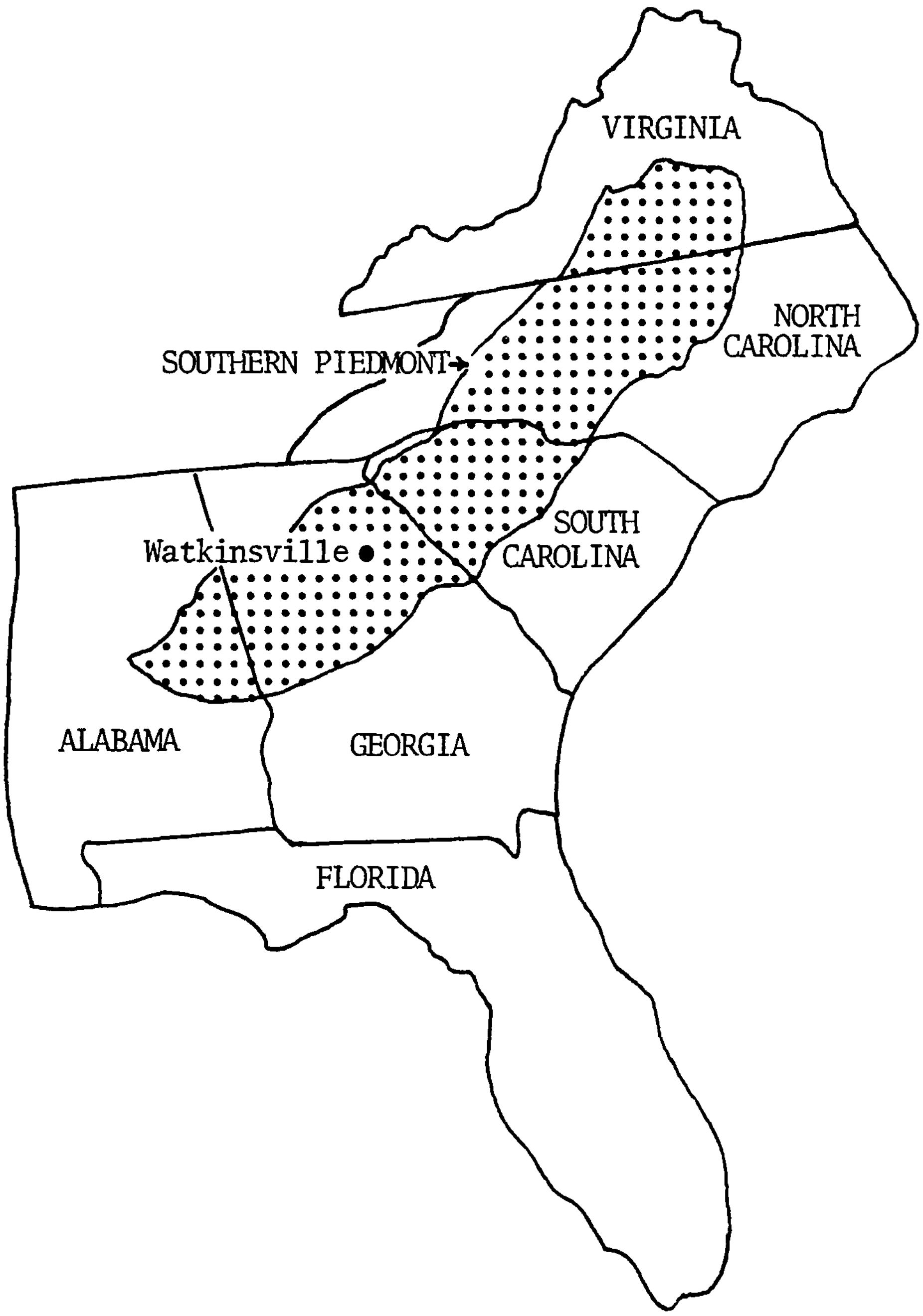


Figure 1. Southern Piedmont physiographic region.

selected for this study and were designated P1, P2, P3, and P4 (Figure 2). The sizes of these areas are 2.70, 1.29, 1.26, and 1.40 hectares, respectively. Small runoff plots of 0.02 and 0.10 hectares were located adjacent to P1 and P3, respectively, and were designated SP1 and SP3. These small plot studies did not yield additional useful data, however, and were discontinued at the end of the first year.

Watershed W1, 7.72 hectares in size, is also delineated in Figure 2. Although this watershed was not directly involved in the pesticide runoff study, past rainfall-runoff records for W1 were used in preliminary calibration for the surface runoff component of a pesticide runoff model for the Piedmont Region.[1] Portions of historical records for this watershed have been previously published.[11]

Twelve small plots, referred to as "attenuation" plots, were located approximately 100 meters east of watershed P3 on essentially level terrain. These plots were instrumented for continuous measurement of soil temperature, soil water content, and other microclimatic variables affecting pesticide behavior and persistence in soil.[12] Pesticide content in the soil and runoff were measured over time and related to the above variables.

Prior to this study, the experimental areas had been in general farm production and all were planted to soybeans, corn, and small grains. None of the pesticides selected for this study had been used previously in quantities that left detectable residues in the soils at the beginning of the study.

The watersheds were selected to represent common land forms and management practices in the Piedmont. Watersheds P1 and P2 were shaped with drainage patterns converging to a central draw. No soil and water conservation measures were initially incorporated in their management. After three crop seasons (1972, 1973, and 1974), however, a central grassed waterway was installed on watershed P1 and no-till practices were followed thereafter.

Figures 3 and 4 show the P1 and P2 watersheds, respectively, as black and white photos of infrared images. These photographs were made from overflights in November 1973 by the Office of Earth Resources, Kennedy Space Center, National Aeronautics and Space Administration as part of an ancillary study on applications of remote sensing to environmental problems. Image contrast shown in the photographs is related to crop residues present and to soil moisture. Results of soil erosion from storm runoff can be seen, particularly on the P1 watershed. Watersheds P3 and P4 were parallel-terraced fields with bisecting grassed waterways to route surface runoff (Figures 5 and 6). Terrace channels on the P4 watershed are evident in Figure 6.

Three different soil types were present on watershed P1 (Figure 7). A gravelly Cecil sandy loam soil (typic Hapludult; clayey, kaolinitic, thermic family) covered most of the watershed. Pacolet gravelly sandy loam, a soil with similar characteristics but having a thinner solum occupied a small area with slopes of 6 to 10 percent. Detailed descriptions of these soils have been published.[13,14] In the lower portion of the watershed, in an area averaging about 2 percent slope, a soil described as a taxajunct to the Starr series was mapped. The first 70 cm of surface soil is of alluvial origin. A

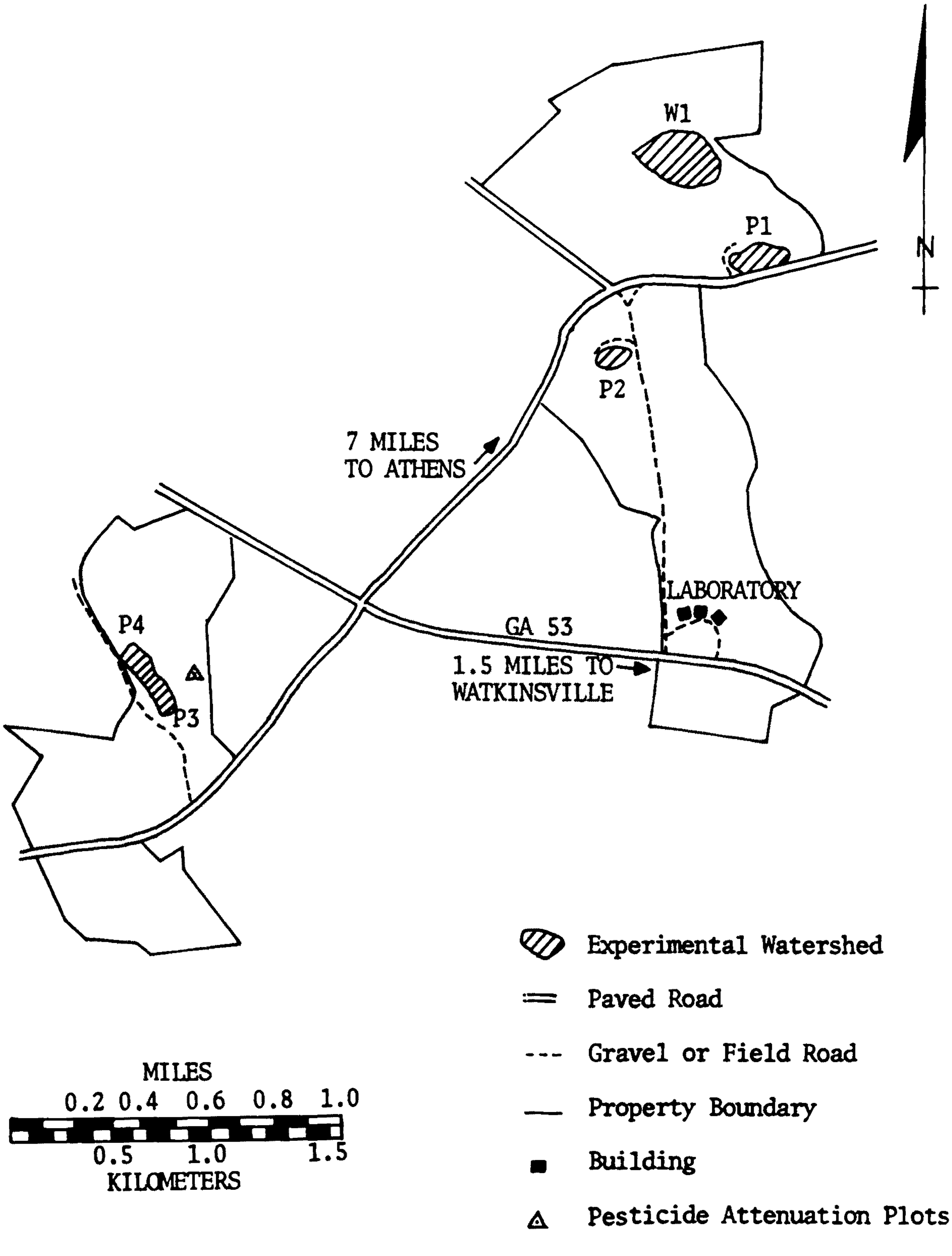


Figure 2. Location of experimental watersheds and pesticide attenuation plots, Southern Piedmont Conservation Research Center, Watkinsville, Georgia.

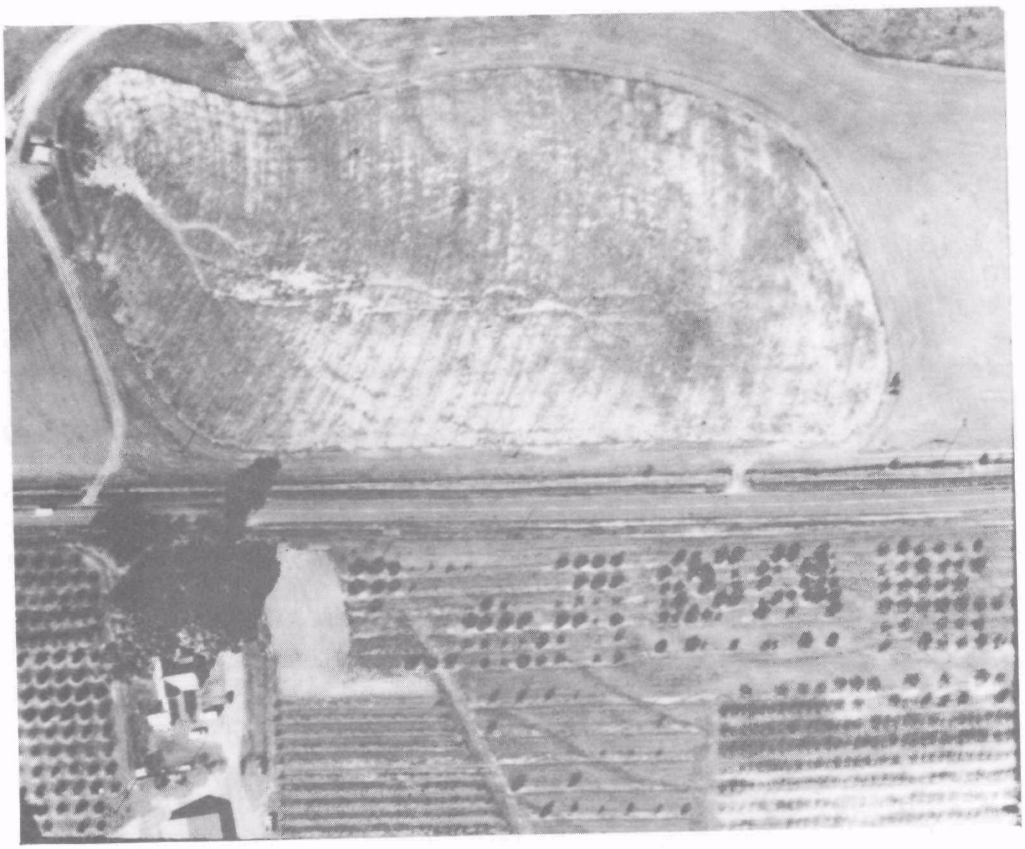


Figure 3. Infrared image of watershed P1, November 1973 (courtesy of NASA).

Figure 4. Infrared image of watershed P2, November 1973 (courtesy of NASA).

Figure 5. Infrared image of watershed P3, November 1973 (courtesy of NASA).

Figure 6. Infrared image of watershed P4, November 1973 (courtesy of NASA).

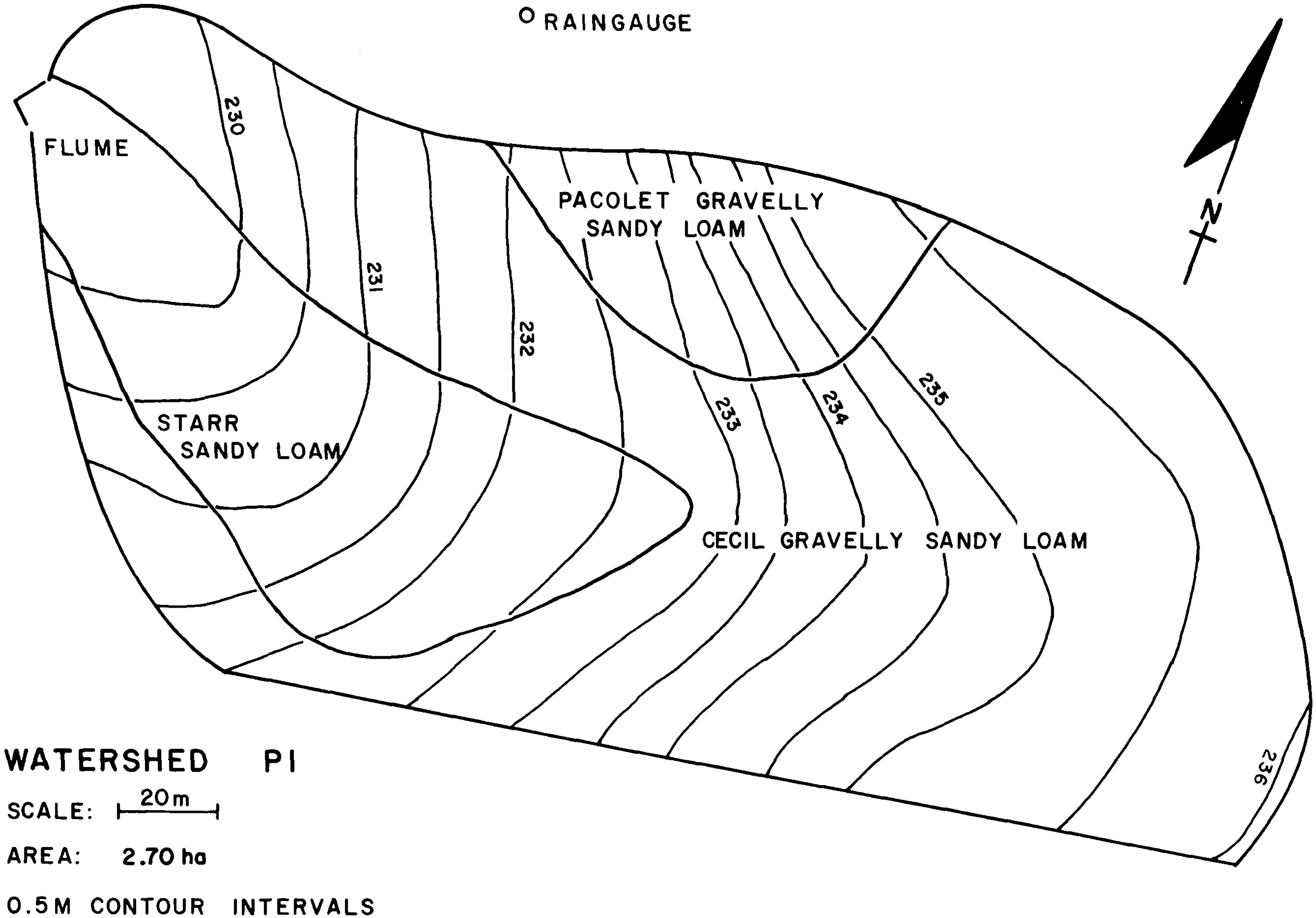


Figure 7. Soils and topography, watershed P1.

detailed Pedon description is given in Figure A1. In normal mapping these soil areas are not delineated from surrounding soils because of their limited extent.

Soils on watershed P2 were also variable, their characteristics depending on where they occurred on the landscape. The major soil was Cecil sandy loam (Figure 8). Small areas around the upper rim of the watershed had a sandy clay loam surface (Ap) as a result of past erosion and mixing of B horizon material with the remaining topsoil during tillage. Similar to P1, soil of alluvial origin occupied the central draw. As shown in Figure 8, the upper portion of this area had a loamy surface distinctly different from the soil on the side slopes. No attempt was made to classify this soil area as to series. Because studies of subsurface movement of chloride and nitrate were planned, however, extensive field investigations were conducted to describe spatial variations in soil characteristics affecting soil water and chemical flux. Assistance was received from Drs. E. C. Gamble and R. B. Daniels, Soil Conservation Service, USDA, Raleigh, North Carolina. The watershed surface was first marked off in 15-meter (50-foot) grids as shown in Figure A2. The numbered grid points served as reference points for characterization and subsequent soil sampling for chloride and nitrate movement. Solum thickness and parent material is shown in Figure 9 for a transect taken through the center of the watershed from the upper watershed boundary to the flume through the central draw or drainage channel (see Figure A2 for location of indicated grid points). An area approximately 100 meters long and 10 to 20 meters wide above the flume in the drainage channel was derived from both "old" and recent alluvium. The old alluvium conceivably exists at present as a remnant of material desposited in past geologic time when the landscape was graded to a stream level higher than the present level. Recent alluvium has been deposited in this area from soil erosion occurring since the land was cleared for crop production.

In Figure 9, three soil horizons are shown. The upper or surface (Ap) represents the plow layer plus the addition of any recent alluvium. Beginning at the uppermost watershed boundary and proceeding on the transect of Figure 9, soil texture ranges from sandy loam to loam to sandy clay loam to sandy loam, respectively (see Figure 8). The B2t horizon is the most clayey horizon with textures ranging from clay to sandy clay. The line drawn between B and C horizon is the base of the B2t. The B horizon developed in the old alluvium is slightly less clayey than that formed from saprolite. Otherwise, it is quite similar. Below the B2t horizon is C material or saprolite modified by soil formation. This material is more micaceous and friable than the B horizon. The saprolite is of granitic origin with foliation suggesting gneiss.

The B2t horizon is the least permeable layer to water movement.[15] Figure 10 shows isometric lines connecting points of equal soil thickness above the B2t horizon. The pattern evolved largely reflects past erosion and deposition.

Watersheds P3 and P4 are depicted in Figures 11 and 12, respectively. Both these watersheds had approximately uniform slopes of 3 percent on transects parallel to the grassed waterways. Terrace channels, indicated by

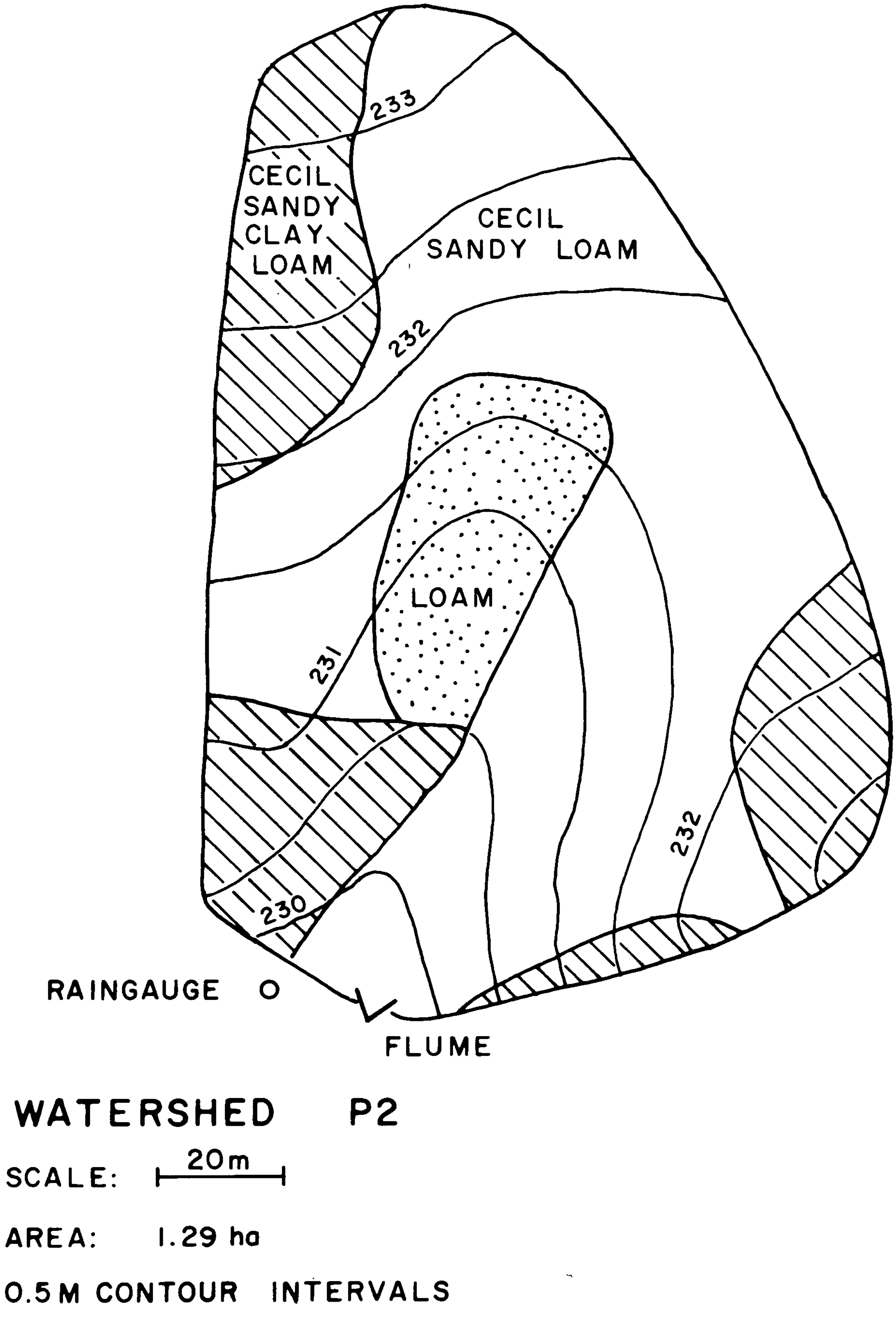


Figure 8. Soils and topography, watershed P2.

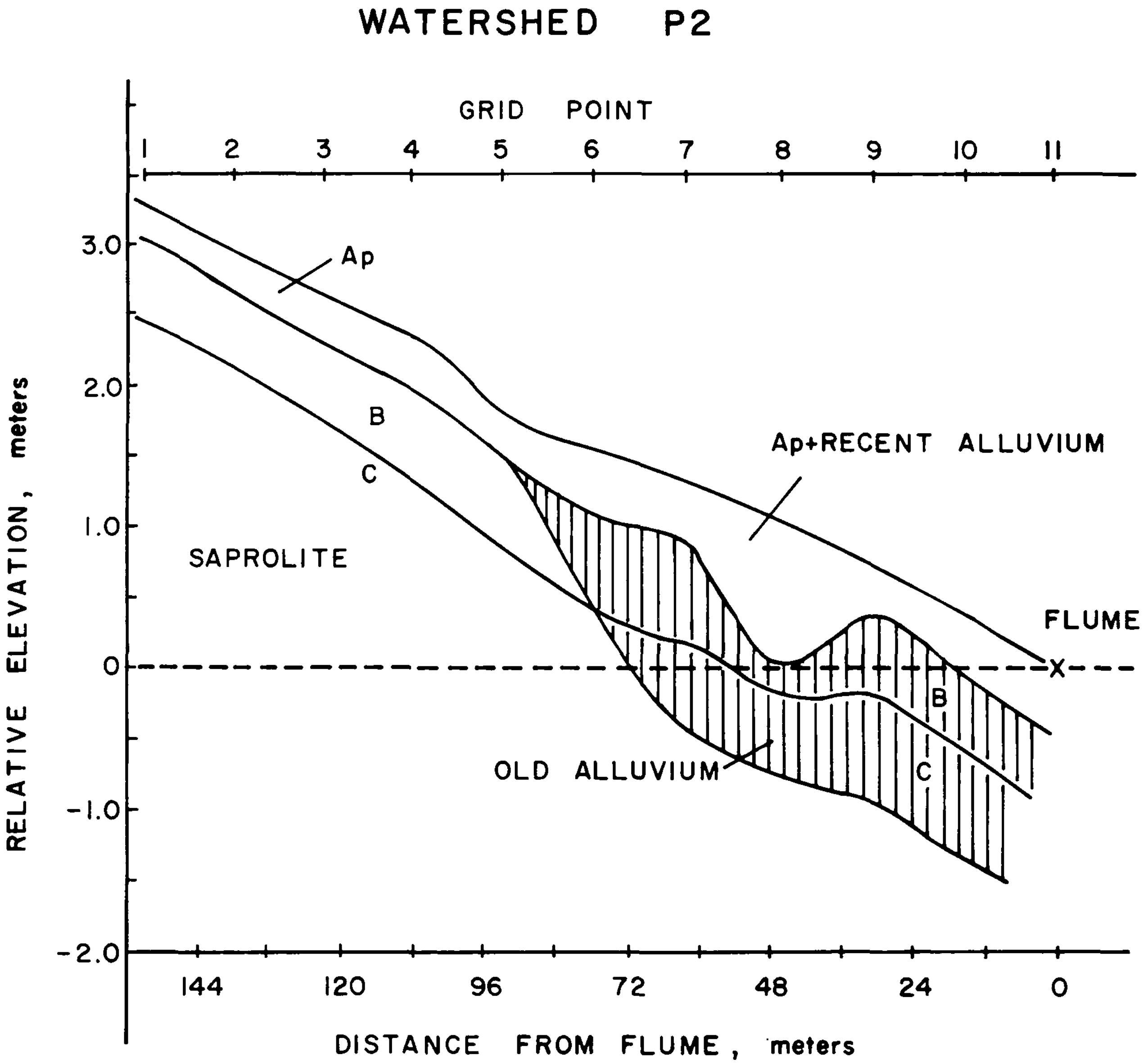


Figure 9. Soil characteristics in transect through central drainage channel, watershed P2.

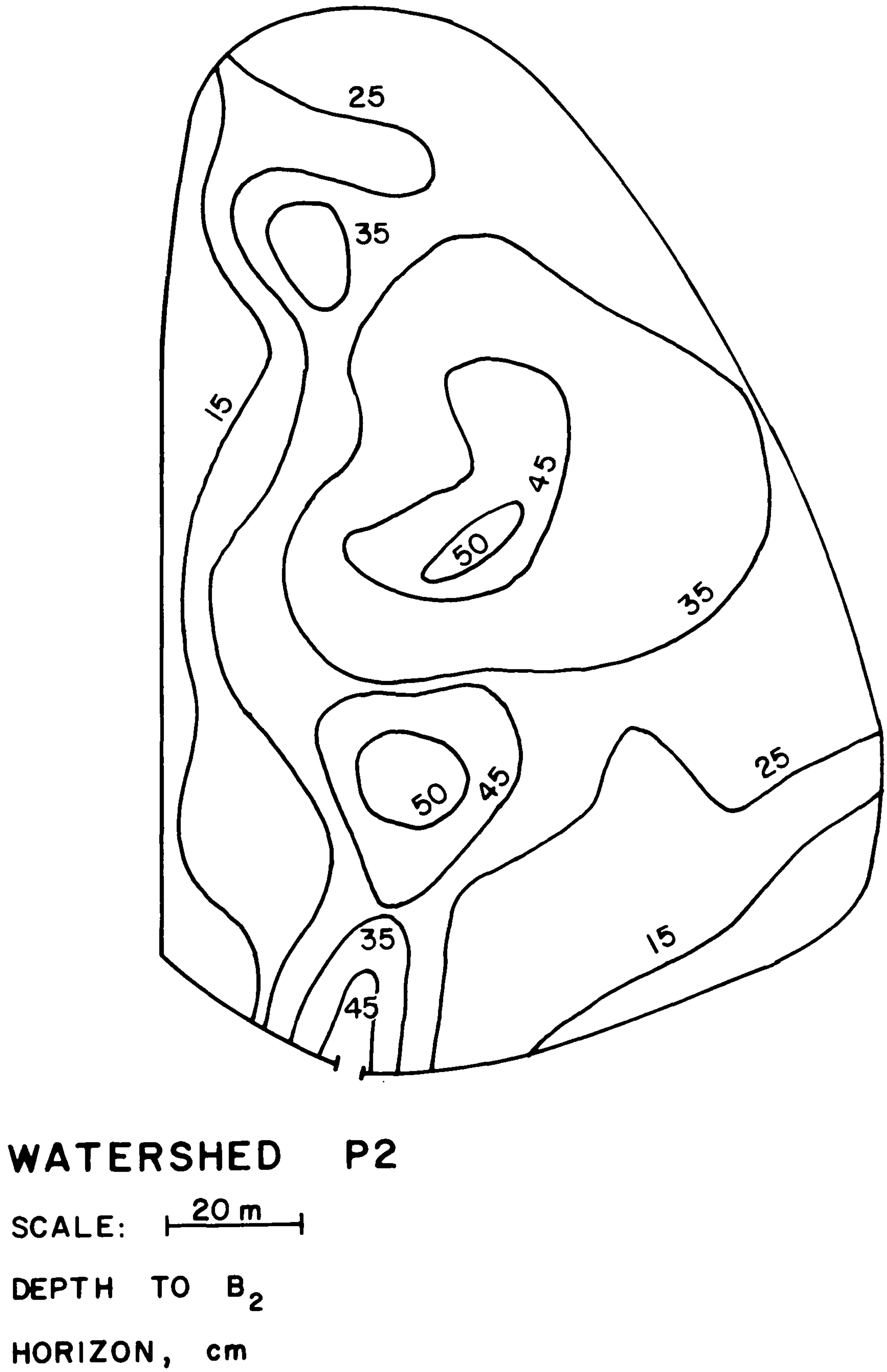


Figure 10. Contours of soil depth to B2 horizon, watershed P2.

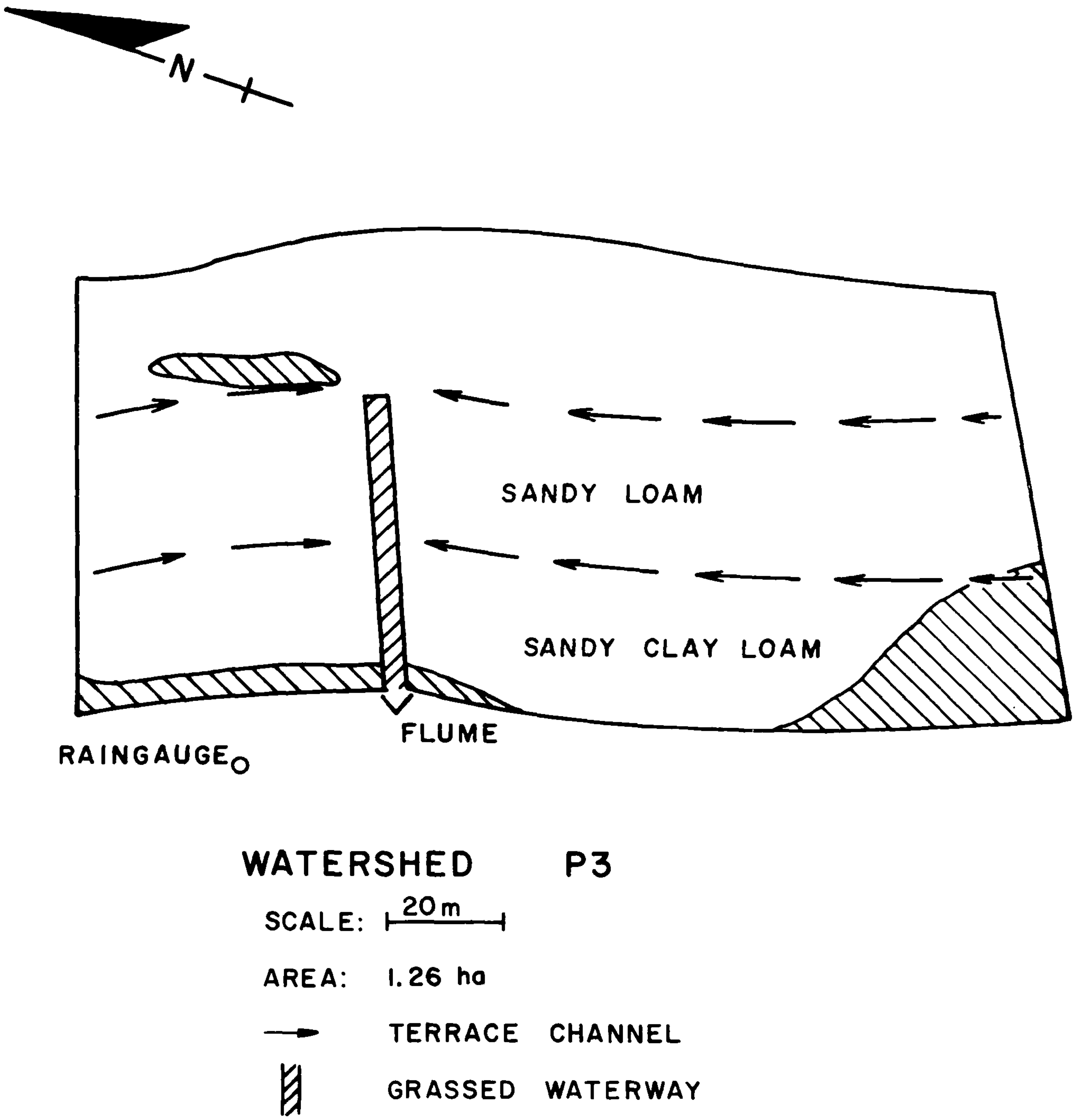


Figure 11. Soils and terrace configurations, watershed P3.

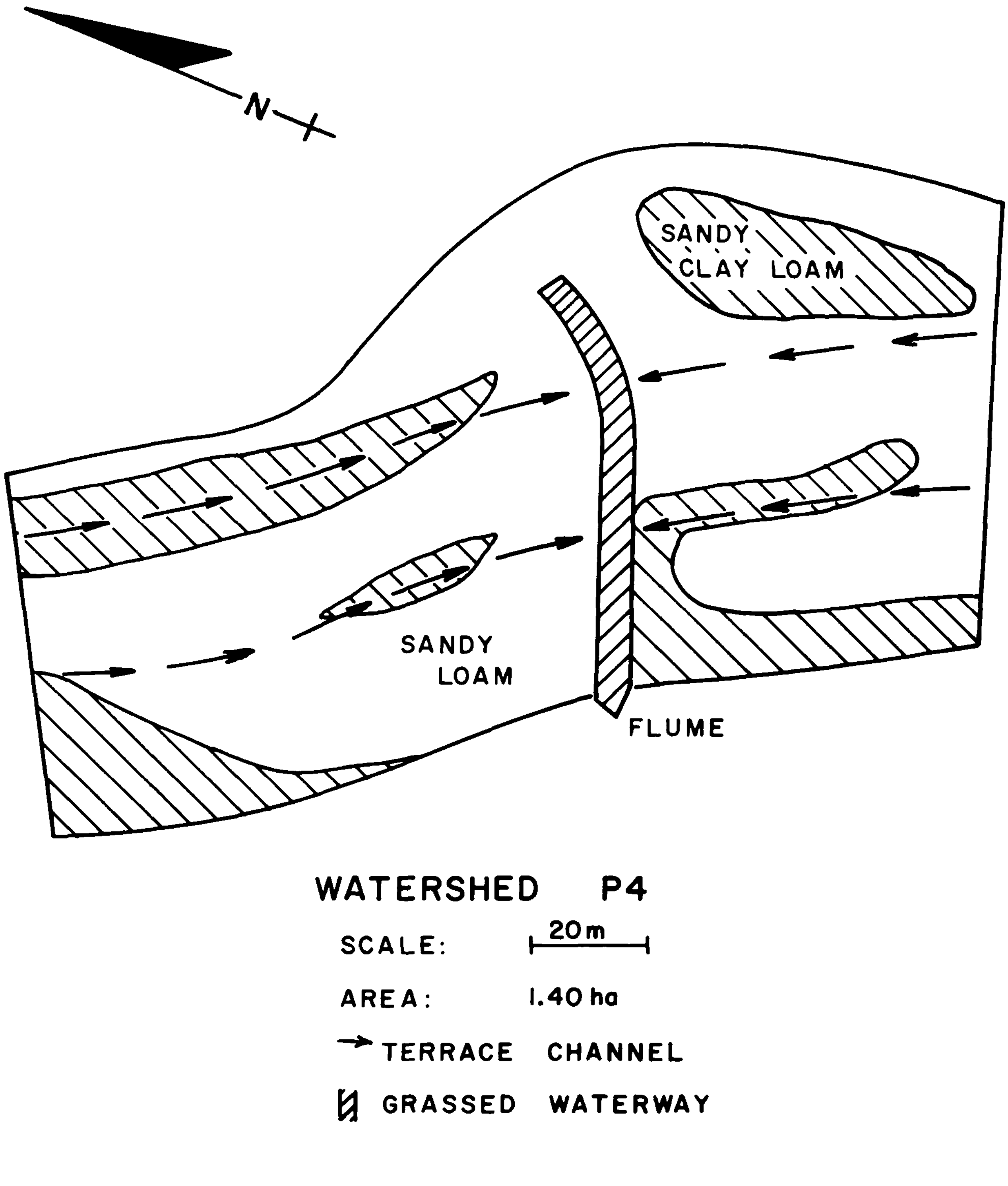


Figure 12. Soils and terrace configurations, watershed P4.

arrows in Figures 11 and 12, were graded towards the grassed waterways (indicated by cross-hatching) with slopes of 1 to 2 percent.

Soils on these watersheds belong to the Cecil series, with surface textures ranging from sandy loam to sandy clay loam (Figures 11 and 12) depending on previous erosion history. Watershed P4 exhibited the greatest degree of erosion. A complete description of soil from a pit dug 10 meters southeast of watershed P3 is given in Figure A3. The pedon described typifies Cecil soils found on the watersheds.

To facilitate watershed sampling for pesticide residue and plant nutrient content, each watershed was divided into several segments. A numbered grid system was also developed for P2 and several transects delineated on P4 for sampling reference (see Figures A2, A4, and A5). Composite soil samples removed from each of these segments were analyzed for soil pH, texture, carbon content, and specific surface area by methods described elsewhere in this report. Results are found in Tables A1 through A4. Segment areas by watershed are given in Table A5.

Particle sizes, pH, specific surfaces, and carbon contents were determined only for surface horizons on P1 and P3. For P2 and P4, particle size, total nitrogen, total phosphorus, and acid-extractable phosphorus were also determined at depth intervals to 152 cm.

SECTION 5

WATERSHED INSTRUMENTATION

Flow measuring devices, automatic runoff samplers, and water level gauges were installed on each watershed as illustrated in Figures 13 through 19. These photographs were taken on the P2 watershed; other watersheds were similarly instrumented. Type-H flumes 76.2 cm (2.5 feet) in height and constructed from 14-gauge stainless steel according to specifications given in Agricultural Handbook 224[16] were located through the lower watershed berm at the end of the waterway or channel draining the watershed (Figures 13 and 14). The flume was equipped with a 1-on-8 sloping false floor and matching approach section to reduce silting within the flume.

Water level in the flume stilling well was recorded with a type FW-1 Belford recorder equipped with timer gears providing time resolution of 2 minutes per minor chart division. Chart times, at the end of a recording period, were compared with a master clock; any gain or loss in time distributed over the time interval was corrected.

Continuous runoff sampling for sediment content and chemical residue was accomplished with a motorized sampling slot traversing forward and back through the flume discharge at a rate of one cycle per minute (Figures 15 and 16). The slot opening was 0.76 centimeters long tapered from 6.4 centimeters wide at the bottom to 3.2 cm wide at the top. (The slot was tapered so that a greater proportion of the runoff at low flows was collected for samples as compared with that collected at high flows.) The slot motor was energized by a microswitch actuated by movement of the float in the flume stilling well when runoff occurred. The runoff collected by the traversing slot was further subdivided by a stationary set of slots located underneath the flume (Figure 17). Runoff collected by the traversing slot poured over the stationary divider slots where the sample volume was reduced by a factor of about 10. The sample flowed by gravity from a collector underneath the divider via a 3.5-cm stainless steel pipe to a sequential sample collector (Figure 18) in a refrigerated compartment (Figure 19).

The sample collector (Figure 19) was constructed from 145-cm outside diameter plyboard rings that were 2.0 cm (3/4 inches) thick with an inside diameter of 94 cm. The moveable top section was mounted on eight swivel casters and held in alignment with the lower section by roller guides around the inside diameter. The top section was powered by three 24-V DC gearmotors mounted at 120-degree intervals around the outside diameter. The motor gears engaged a roller chain secured around the periphery of the top section. Samples were collected in 10-liter stainless steel Marie pots positioned on

Figure 13. H-type flume with sloping floor approach, watershed P2.

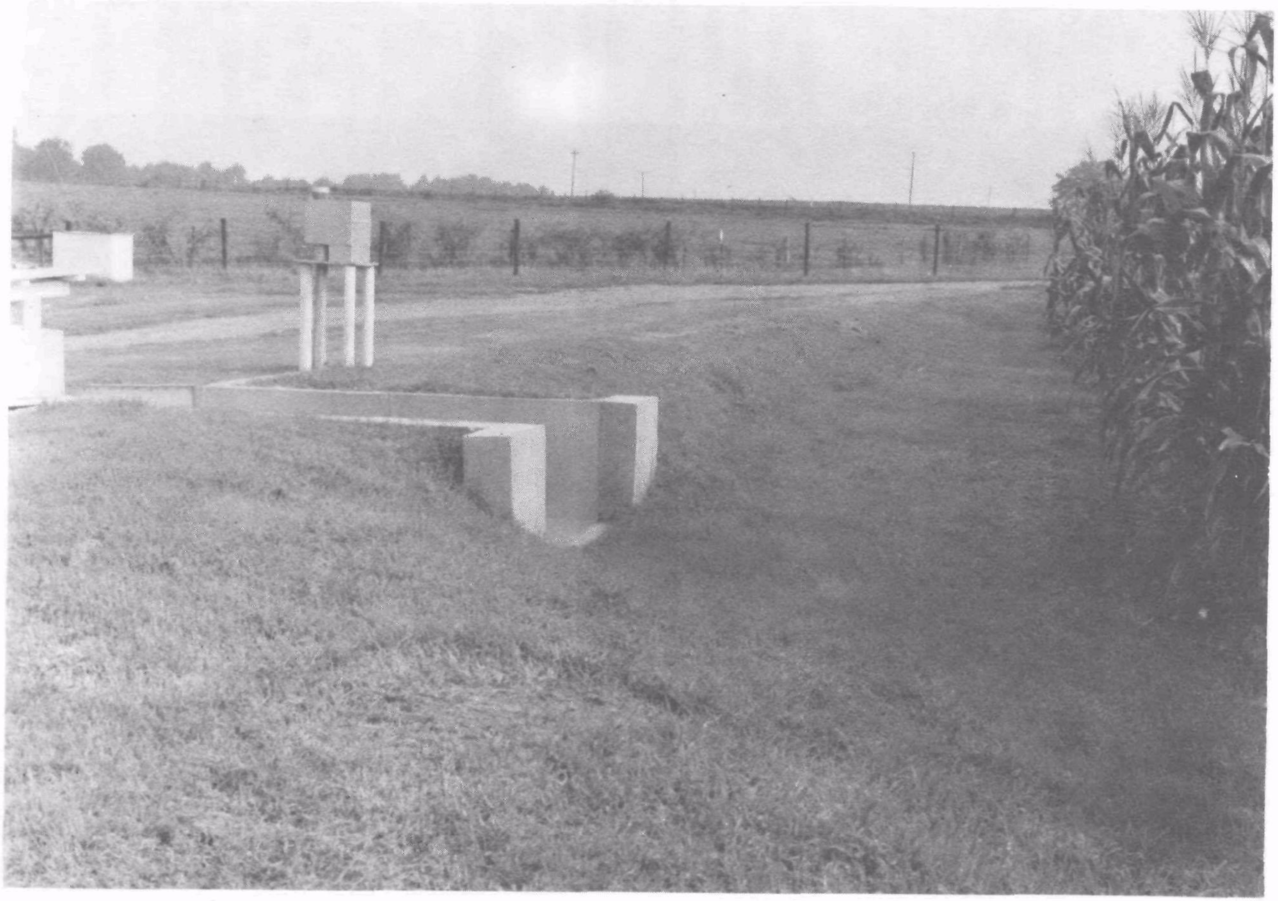


Figure 14. Location of flume approach through lower berme, watershed P2.

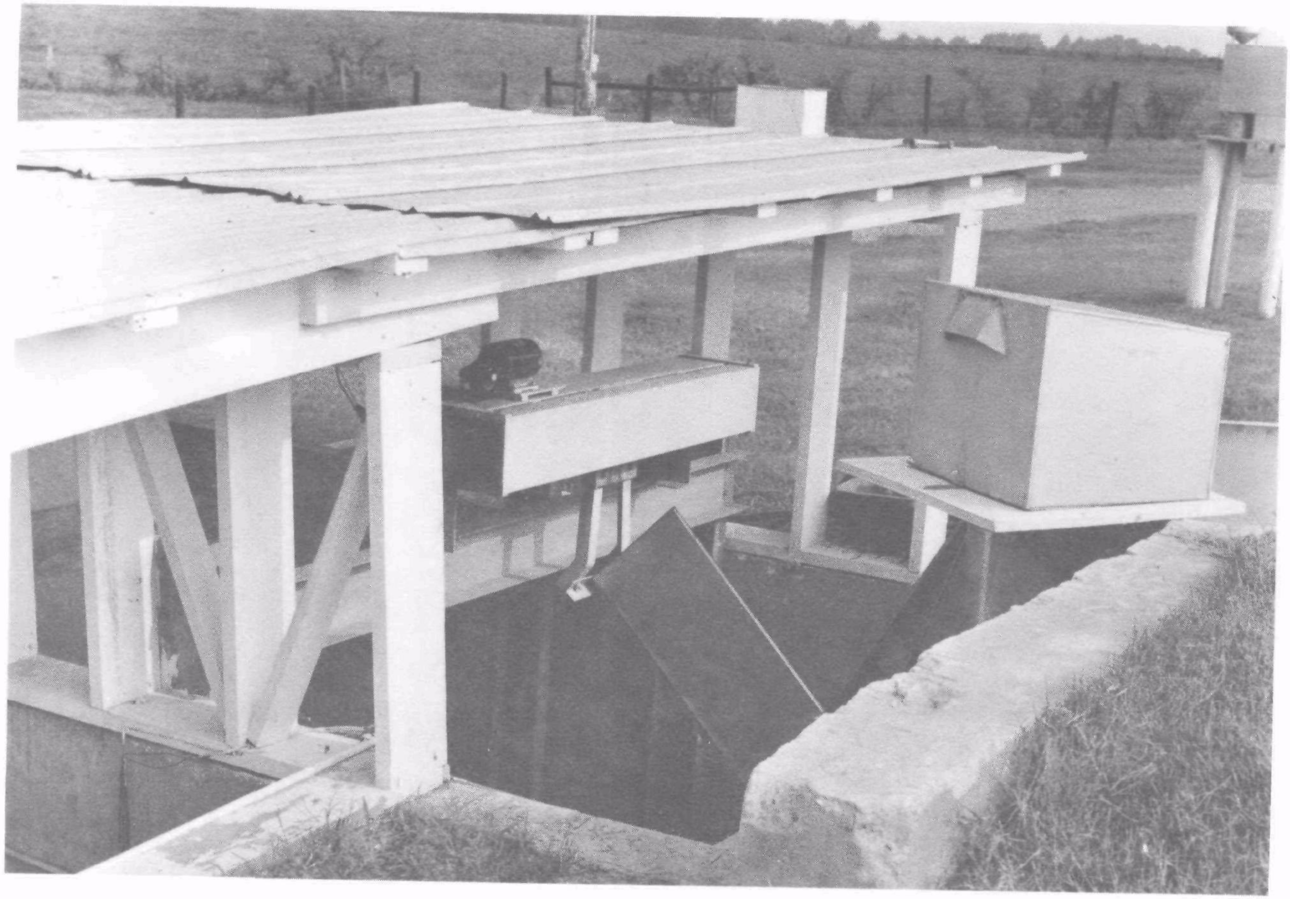


Figure 15. Motorized traveling slot runoff sampler located below flume, watershed P2.

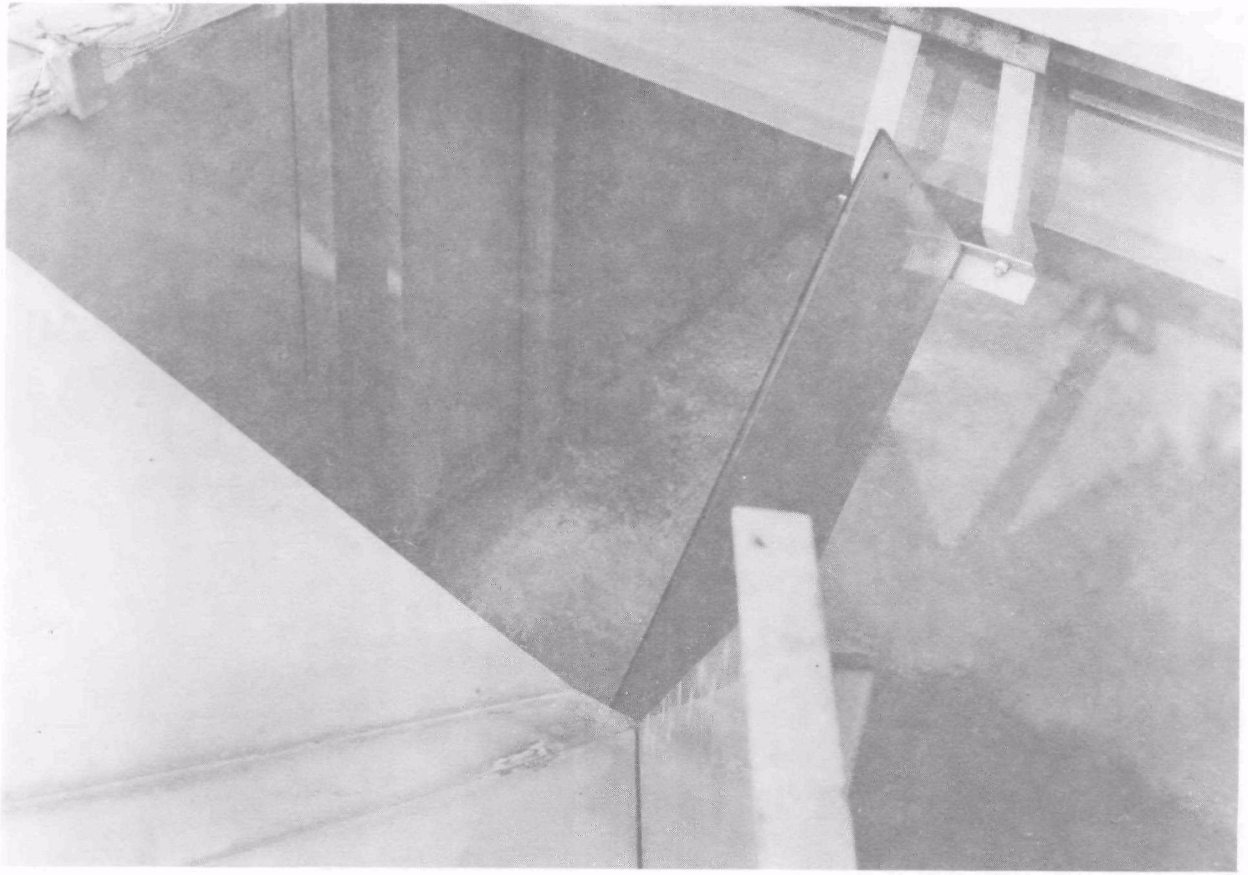


Figure 16. Sampling slot closeup, below flume, watershed P2.

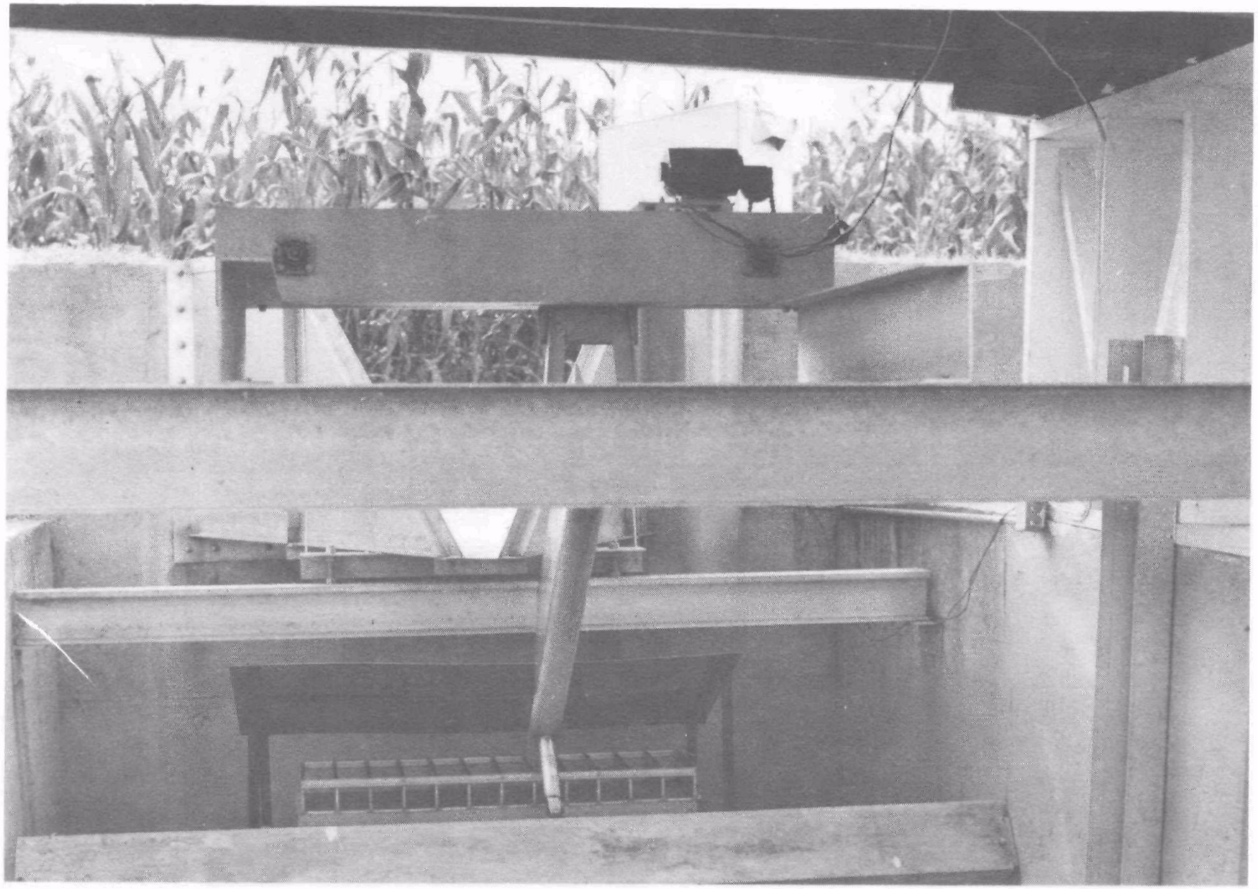


Figure 17. Stationery slot runoff sample divider, below motorized slot, watershed P2.

Figure 18. Overall view of flume, slot sampling system and sequential sample collector in refrigerated compartment, watershed P2.

Figure 19. Sequential runoff sampler collector in refrigerated compartment, watershed P2.

the collector. In operation, runoff samples flowed directly from the delivery pipe into the pot until a given pot was filled to about 3 cm from the top. At this level, a float attached to an arm on the delivery pipe was raised sufficiently to actuate a microswitch that energized the three drive motors. The sample collector then rotated until the float arm dropped into the next pot deenergizing the drive motors. In this way, fourteen 10-liter samples could be collected sequentially. On P2 and P4 watersheds, the float microswitch also activated an event marker on a separate clock-driven chart (modified FW-1 recorder) so that each sample time interval was known. On P1 and P3 watersheds, the event marker was placed so that sample time was marked directly on the waterstage chart. The system was designed so that if the 14-sample capacity was exceeded in a single runoff period, subsequent runoff sample was diverted from the last pot into a large overflow tank occupying the interior space of the collector. This tank also had an overflow pipe diverting additional excess as waste out of the refrigerated compartment. The last pot was equipped with a false bottom and spout to divert flow into the overflow tank.

Temperature inside the sample compartment was maintained at 4 °C by a forced-air refrigeration system.

The entire sampling system, except for the refrigeration unit, was powered by direct current from an AC/DC converter and storage batteries to ensure operation in the event of temporary power outages during thunderstorms.

Recording raingauges were located adjacent to watersheds P1 and P3 at the beginning of the data collection period (30 June 1972). The same raingauge was used for rainfall measurement for both P3 and P4. During the initial year (May 1973 to May 1974) of record on P2, rainfall data were taken from either the P1 gauge or a gauge about 300 meters south of P2. Which gauge was used was determined from observed storm tract and cell size. A continuous recording raingauge adjacent to P2 was used from 21 May 1974 to 30 April 1975 at which time the rainguage became unreliable and the above procedure was followed for the remainder of the study.

A U.S. Weather Bureau Class A evaporation pan and anemometer were located adjacent to watershed P3 in October 1972. The water level was recorded continuously using an expanded scale stage recorder as described by Ellis and Thomas.[17] Additional pan evaporation data were obtained from a pan located adjacent to the attenuation plots (Tables C36 through C39).

Devices for collecting rainfall samples of nutrient analysis consisting of a 9-inch glass funnel mounted in a supporting box so that it drained into a 500-milliliter (ml) plastic bottle were constructed and installed near watersheds P2 and P3 in 1974. The glass funnel was protected from dust and fowl excreta by an aluminum cover than was removed by a reversing electric motor only during rainfall. The electric motor was energized by a change in resistance of a sensor when rainfall occurred. The device was similar to that described by Bentz[18] with modified circuitry to improve performance.

In Figure 20, from left to right, can be seen the recording raingauge, rainfall sample collector, evaporation pan, and evaporation pan level recorder as installed on the P3 watershed.

Detailed drawings illustrating most of the instrumentation described above are on file at the Southern Piedmont Conservation Research Center for additional reference.

Gypsum resistance blocks were installed during the first year of the study on watershed P1 and P3 shortly after crop planting so that soil water regimes could be characterized at selected times throughout the cropping season. Resistance blocks were located at seven sites on P1 and 19 sites on P3, selected to give adequate sampling of the watersheds. Blocks were installed at seven depths per site, that is, at 5, 15, 30, 60, 90, 120, and 180 cm. Measurements were continued for three cropping seasons before block deterioration made further measurements unreliable. Resistance blocks were not installed on watersheds P2 and P4 because these watersheds were to be core-sampled throughout the cropping season such that soil water was obtained incidentally by gravimetric procedures (details elsewhere in this report).

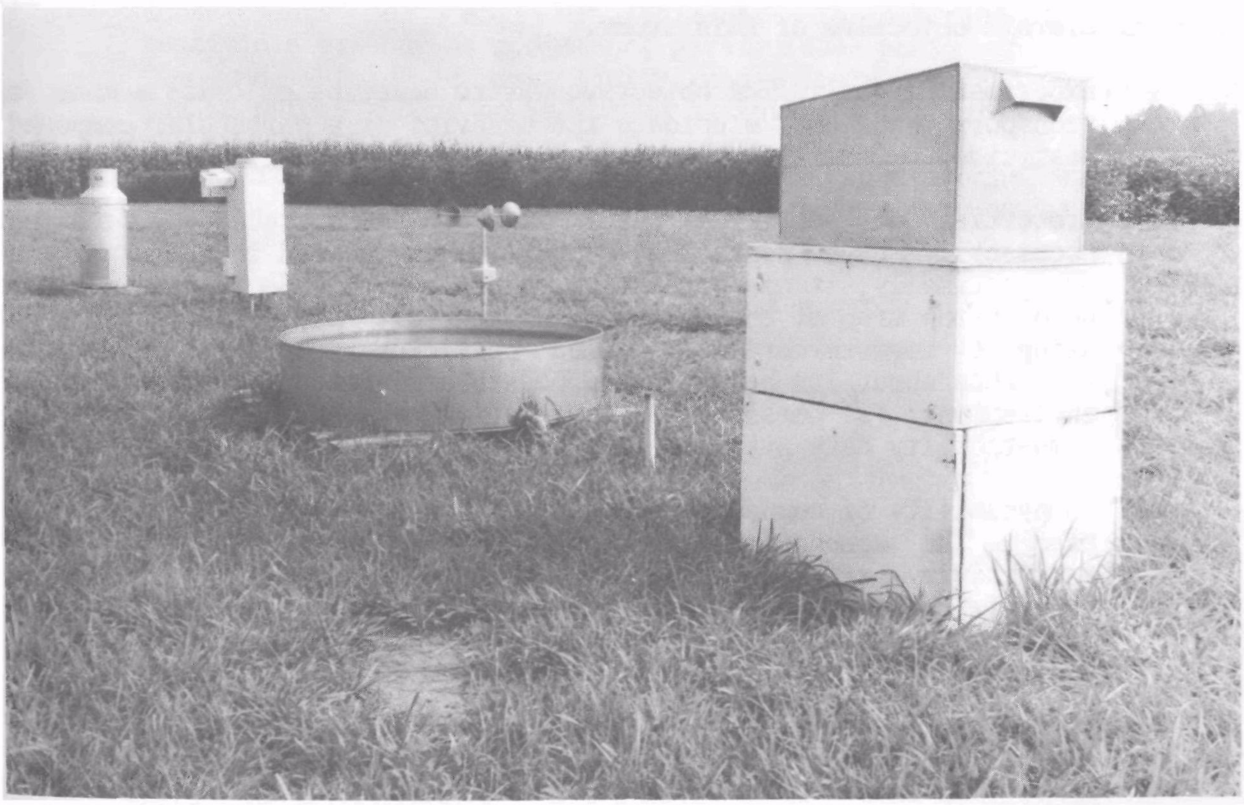


Figure 20. Raingauge, rainfall sampler, evaporation pan, and evaporation recorder (left to right), watershed P3.

SECTION 6

EXPERIMENTAL DESIGN AND PROCEDURES

PESTICIDE SELECTION CRITERIA

The overall objectives of the project were to collect necessary data for developing models for predicting agricultural chemical runoff from small watersheds. It was assumed that development of models for pesticide runoff would be simplified if the compounds selected for study were transported primarily by only one of the following modes: dissolved in runoff, bound on eroded soil particles, carried as particulates in runoff, dissolved in percolating soil water, or volatilized into the atmosphere.

The following criteria were used, therefore, in deciding on the suitability of a compound to describe a particular mode of transport and fit into the overall objective of this study.

- Experimental goal: The objective was to describe or trace a mode of transport and not elucidate the behavior of a particular compound, pesticide, or family of pesticides.

- Properties of pesticide used: The compound selected need not necessarily have pesticidal properties as applied in the experiment but, optimally, it was beneficial to use a herbicide that normally is used on the crop of choice for weed control. Other advantages of using a registered and labeled pesticide include (1) information available about its behavior and possible or potential effects on the environment; (2) persistence information available; and (3) crop compatibility data available.

- Compatibility of compound with crop and cultural practices to be used: The compound should not interfere with the life cycle and productivity of the crop at the rate required for analytical sensitivity over at least one growing season. Optimally, the compounds chosen should be compatible in the sprayer and during application. Most important was that the two or more compounds used not result in the occurrence of a synergistic reaction with the crop specie used.

- Acceptable persistence and attenuation behavior: Optimally, to model pesticide transport in runoff water, bound on transported sediment, and redistribution in the soil, the compound should be a conservative entity. From a practical standpoint, however, only a persistent organic compound -- that is, one for which the rate of degradation is slow and can be defined over at least the growing season or longer -- is feasible.

- Acceptable level of mammalian toxicity: Sampling requirements dictate that personnel be on the ground in proximity to the sprayer during and immediately following application. Compounds that are both acutely toxic and highly volatile could not be used.

- Analytical procedure: The analytical method must have a minimum sensitivity in the low parts per million to the high parts per billion range. The methodology for the test compounds must be compatible with an integrated approach that would permit the analysis of at least 75 samples per week by the available personnel.

- Irreversibly bound in the sediment phase: To describe pesticide transport on sediment, the compound should be irreversibly bound to all types of clay minerals, oxides and hydroxides and organic matter normally found in soil. The compounds should not be present at detectable limits in the soil solution or in the runoff water.

- Water solubility: To describe transport in runoff water or in the percolating soil solution, the compound should be readily soluble in water and not be adsorbed by either the mineral or organic constituents of soil or sediment. To describe transport of pesticides present as a distinct particulate phase in runoff, the compound should be essentially insoluble in water (high ppt or low ppb in water) and be non-adsorbed by soil constituents.

- Volatility: To serve as a model compound for the vapor phase transport mode, the test compound should have a high vapor pressure and a low solubility.

In practice, it was impossible to select a group of test compounds to meet all the above criteria. As the best compromise, the following were selected:

- Adsorbed phase - paraquat
- Primarily solution phase diphenamid, atrazine, cyanazine,
- propazine, and 2,4-D
- Vapor phase - trifluralin
- Particulate phase - trifluralin

As will be shown in the results section, however, trifluralin transport in runoff was primarily in solution. The chloride ion was also selected to study solution phase transport of a very mobile entity. All of the organics selected were herbicides, the properties of which are shown in Table 1. Paraquat, however, was not applied to the soil at rates and by methods normally used for this herbicide for the 1972 growing season in particular. In subsequent years, the rates more nearly approximated conventional rates. The reader, therefore, is cautioned not to interpret results for paraquat as representing normal behavior of the compound. Interpretation of the paraquat

TABLE 1. PROPERTIES OF SELECTED HERBICIDES

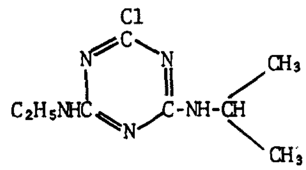
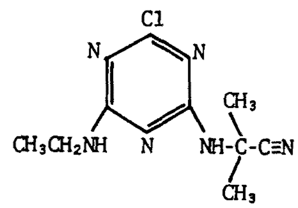
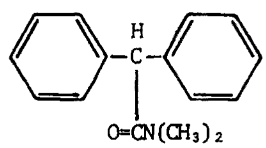
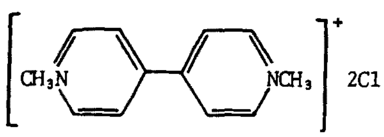
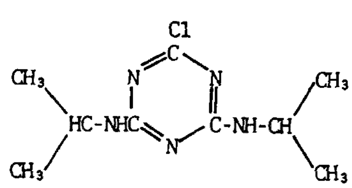
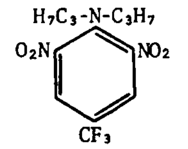
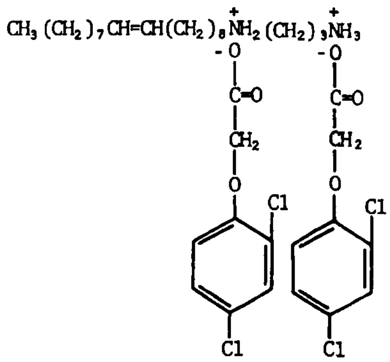
Compound	Structural Formula	Properties
<u>Atrazine</u>* 2-chloro-4-(ethylamino)-6-(isopropylamino)-s-triazine Aatrex 80W† Formulation: 80% wettable powder Manufacturer: CIBA-GEIGY Agricultural Chemical Company		Molecular formula: $C_8H_{14}ClN_5$ Molecular weight: 215.7 Melting point: 173-175°C Vapor pressure: Temperature, °C — mm Hg 10 — 5.7×10^{-8} 20 — 3.0×10^{-7} 30 — 1.4×10^{-6} 50 — 2.3×10^{-5} Water solubility: 33 ppm at 27°C Physical state and color: white, crystalline solid
<u>Cyanazine</u>* 2-(4-chloro-6-ethylamino-s-triazine-2-ylamino)-2-methyl proprionitrile Bladex† Formulation: 80% wettable powder Manufacturer: Shell Chemical Company		Molecular formula: $C_9H_{13}ClN_6$ Molecular weight: 240.7 Melting point: 166.5-167°C Vapor pressure: at 20°C 1.6×10^{-9} mm Hg Water solubility: 23°C 160 ppm; 25°C 171 ppm Physical state and color: White, crystalline
<u>Diphenamid</u>* NN'-dimethyl-2,2-diphenylacetamide Enide† Formulation: 50% wettable powder Manufacturer: Upjohn Company		Molecular formula: $C_{16}H_{17}NO$ Molecular weight: 239.3 Melting point: 132-135.5°C Water solubility: 260 ppm Physical state and color: White or off-white crystalline solid
<u>Paraquat</u>* 1,1'-dimethyl-4,4'-bipyridylium ion Ortho paraquat† Formulation: Aqueous concentrate, 2 pounds cation per gallon Manufacturer: Chevron Chemical Company		Molecular formula: $C_{12}H_{14}N_2Cl_2$ Molecular weight, cation: 186.2 Melting point: salt decomposes at high temperatures Vapor pressure: Non-volatile Water solubility: Completely soluble Physical state and color: White crystalline solid
<u>Propazine</u>* 2-chloro-4,6-bis(isopropylamino)-s-triazine Milogard† Formulation: 80% wettable powder Manufacturer: CIBA-GEIGY Agricultural Chemical Company		Molecular formula: $C_9H_{16}N_5Cl$ Molecular weight: 229.7 Melting point: 212-214°C Vapor pressure: at 20°C 2.9×10^{-8} mm Hg Water solubility: 8.6 ppm at 20-22°C Physical state and color: Colorless, crystalline

TABLE 1 (continued). PROPERTIES OF SELECTED HERBICIDES

Compound	Structural formula	Properties
Trifluralin* α,α,α-trifluroro-2,6-dinitro-N,N-dipropyl-p-toluidine Treflan† Formulation: Emulsifiable concentrate Manufacturer: Eli Lilly and Company		Molecular formula: $C_{13}H_{16}F_3N_3O_4$ Molecular weight: 335.3 Melting point: 48.5-49°C Vapor pressure: at 29.5°C 1.99 x 10^{-4} mm Hg Water solubility: <1 ppm Physical state and color: Orange crystalline sollid
2,4-D oil soluble amine salt N-olyl-1,3-propylenediamine salt of (2,4-dichlorophenoxy) acetic acid Dacamine† Formulation: Emulsifiable concentrate, 2-4 pounds of 2,4-D per gallon of the acid		Molecular formula: $C_{37}H_{56}Cl_4N_2O_6$ Molecular weight: 766.6 Water solubility: Essentially insoluble in water Physical state and color: Hard brown amorphorous solid

*Common name.

†Trade name.

data should be limited to describing processes of pesticide movement via "piggy-back" transport on eroded soil particles.

After tentative selection of paraquat, diphenamid, and trifluralin as the model pesticides, greenhouse and growth chamber studies were conducted to test for possible phytotoxic and synergistic effects on soybean emergence and growth. Combinations of the above compounds at different rates were applied to soybeans seeded in Cecil sandy loam in 3.8-liter (1-gallon) metal cans. Some phytotoxic and synergistic effects were observed for trifluralin and for one formulation of diphenamid but at rates much higher than chosen for this study.

AGRONOMIC AND CULTURAL PRACTICES

Soil type, land form and slope and management practices were variables among the four watersheds of this study. Conservation practices were included on watershed P3 and P4 during the entire study period. Graded parallel terraces were installed 25.6 meters apart (Figures 11 and 12). These terraces were spaced to facilitate four-row implements (3.7 meter intervals). Four-meter-wide bisecting grass waterways were established directly behind the flume approaches (Figures 21 and 22). Rye was seeded each fall on these watersheds (P3 and P4) for winter cover. Conservation practices were not established on watersheds P1 and P2 during the first 3 years of study although

Figure 21. Grassed waterway on watershed P3 and surrounding soybean canopy, August 1975.

Figure 22. Grassed waterway on watershed P4 and surrounding corn canopy, August 1975.

row directions were generally across the predominant slopes. An 11-meter-wide grass (fescue) waterway (0.32 ha) was established in watershed P1 (Figure 23). No-till planting practices beginning in October 1974 were then followed on this watershed for the remainder of the study. Details of field operations are given in Appendix B.

Fertilization

Fertilization dates and rates expressed as N, P, and K (elemental basis) are given in Table 2. All complete fertilizers (granular formulation) were broadcast and incorporated before planting except during the no-till sequence on watershed P1. Preplant fertilizers applied to watershed P2 and P4 were specifically formulated to supply 112 kg Cl/ha from a muriate of potash (KCl) source. This fertilizer was incorporated to an average depth of 10 cm with a contrarotating tine tiller operating 15 cm deep (Figure 24). After incorpration, approximately 90 percent of the KCl source remained in the surface 6 cm. To supply nitrogen, a urea-ammonia solution containing an oil base source of 2,4-D was applied as a directed spray to control broad-leafed weeds to watersheds planted in corn and grain sorghum. All other fertilizers were commercially available materials that were routinely applied at optimum rates for a given plant species. In the Southern Piedmont, soybeans usually require less than 25 kg N and corn-grain sorghum as much as 120 kg N/ha irrigation. Watersheds P1 and P3 were fertilized twice in 1973 because heavy rain and severe erosion occurred (28 May), prior to soybean planting and herbicide application.

Crop Selection

Georgia Experiment Station crop performance reports were used to select plant varieties and planting dates appropriate for the model herbicides. Recommended varieties and seeding dates are given in Table 3. Fungicide treatments, micro-nutrients, and bacteria innoculant are given in footnotes of this table. Soybean (<u>Glycine max.</u> L) photoperiodism dictated a late maturing variety, Coker 318, because of a late planting date in 1972. Common Bermuda grass (<u>Cynodon dactylon</u>) was used to establish a grassed waterway on P3 also because of late planting in 1972. Fescue (<u>Festuca arundinacea</u>) was used to establish grass waterways on watersheds P1 and P4, which were fall-seeded (Figures 22 and 23).

Pesticide Application

Herbicides were mixed with water or N-solutions in aluminized steel sprayer tanks with mechanical agitators. Spraying Systems' 8002 and 8004 stainless steel, flat spray (80 degree series) nozzle tips were used for low and high volume solutions, respectively (Figure 25). Nozzles were spaced 51 cm apart (18 each) on a wet boom mounted 48 cm above the soil surface. The sprayer was equipped with a slow-down drive mechanism for control of ground speed on irregular slopes. Rigorous calibration procedures were used to obtain appropriate spray volumes with a conventional quad-piston pumping system. A constant displacement pumping system was used to apply N solution mixed with 2,4-D.

Figure 23. Grassed waterway on watershed P1 and grain sorghum canopy, August 1975.

The herbicide application rates (active ingredient) used are shown in Table 4. All herbicides used were applied following label requirements and at recommended rates except paraquat and the 3.36 kg/ha atrazine-cyanazine mixture for watersheds P2 and P4 during 1975. As explained previously, paraquat was used only as a model compound for sediment transported chemicals.

The herbicides used (Table 4) consist of wettable powders, emulsifiable concentrates, and ionizable salts. Atrazine, propazine, and cyanazine occur as 80 percent wettable powders and diphenamid as a 50 percent wettable powder. Trifluralin occurs as an emulsifiable concentrate; paraquat and 2,4-D occur as ionizable salts. Trifluralin was applied as a single chemical in a solution volume of 187 liter/ha. Wettable powder herbicides were mixed for a single solution application volume of 374 liter/ha. Paraquat, when applied, was also

TABLE 2. DATES AND RATES OF FERTILIZATION

	Fertilizer* formulation†, N-P-K, kg/ha			
Application date	Watershed P1	P2	P3	P4
06-16-72	5-15-56		5-15-56	
05-11-73		28-17-127		28-17-127
05-22-73	21-19-53		21-19-53	
06-04-73	25-22-62		25-22-62	
06-23-73		112-00-000		112-00-000
04-29-74		38-33-127		38-33-127
05-22-74	17-15-41		17-15-41	
06-11-74		112-00-000		112-00-000
02-01-75	73-22-62			
04-24-75		22-21-000		22-21-000
05-08-75			0-15-45	
05-14-75				0-00-112
05-21-75		0-00-112		
06-25-75		112-00-000		112-00-000
07-07-75	90-00-00			

*Elemental values.

†Nitrogen source in complete fertilizer was ammonium nitrate, NH_4NO_3, ammonium sulfate, $(NH_4)_2SO_4$, or either monoammonium phosphate, $NH_4H_2PO_4$ or diammonium phosphate, $(NH_4)_2HPO_4$. Nitrogen source in incomplete fertilizer was a urea-ammonia solution. Potassium and chloride source was muriate of potash, KCl.

Figure 24. Contrarotating tine tiller with mounted planters.

TABLE 3. SEEDING DATES OF CROP VARIETIES USED

Planting date	Watershed P1	P2	P3	P4
06-30-72			Soybean (Coker 318)	
07-01-72	Soybean (Coker 318)			
09-29-72†			Rye (Explorer)	Rye (Explorer)
05-11-73		Corn (Pioneer 3009)		Corn (Pioneer 3009)
06-13-73	Soybean (Bragg)			
06-15-73			Soybean (Bragg)	
10-05-73†			Rye (Explorer)	Rye (Explorer)
04-29-74		Corn (Pioneer 3009)		Corn (Pioneer 3009)
05-30-74	Soybean (Bragg)		Soybean (Bragg)	
10-19-74				Rye (Explorer)
10-22-74†	Barley (Barsoy)		Barley (Barsoy)	
05-14-75				Corn (Pioneer 3009)
05-21-75		Corn (Pioneer 3009)		
05-28-75			Soybean (Bragg)	
06-02-75‡	Grain Sorghum (Dekalb BR-54)			
10-29-75‡	Barley (Keowee)			
11-20-75			Barley (Keowee)	Barley (Keowee)

*Seed rate and treatment:

Barley (Hordeum vulgare) 3.23 x 10^6 seeds per hectare.
Corn (Zea may L.) 5.36 x 10^4 seeds per hectare. Seed fungicide included 150 grams of Arason 50 (50% Thiram-Tetramethyltiuram disulfide) per hectare.
Grain Sorghum (Sorghum vulgare Pers.) 2.15 x 10^5 seeds per hectare.
Rye (Secale cereale) 4.98 x 10^6 seeds per hectare.
Soybean (Glycine max. L.) 4.31 x 10^5 seeds treated with 18 grams of sodium molybdate per hectare plus Rhizobium innoculant. Seed fungicides included 29 grams Pentachloronitrobenzene and 7 grams of 5-Ethoxy-3-trichloromethyl-1,2,4-thiadiozole per hectare.

†Aerially seeded immediately prior to soybean senesence.

‡No-till planted.

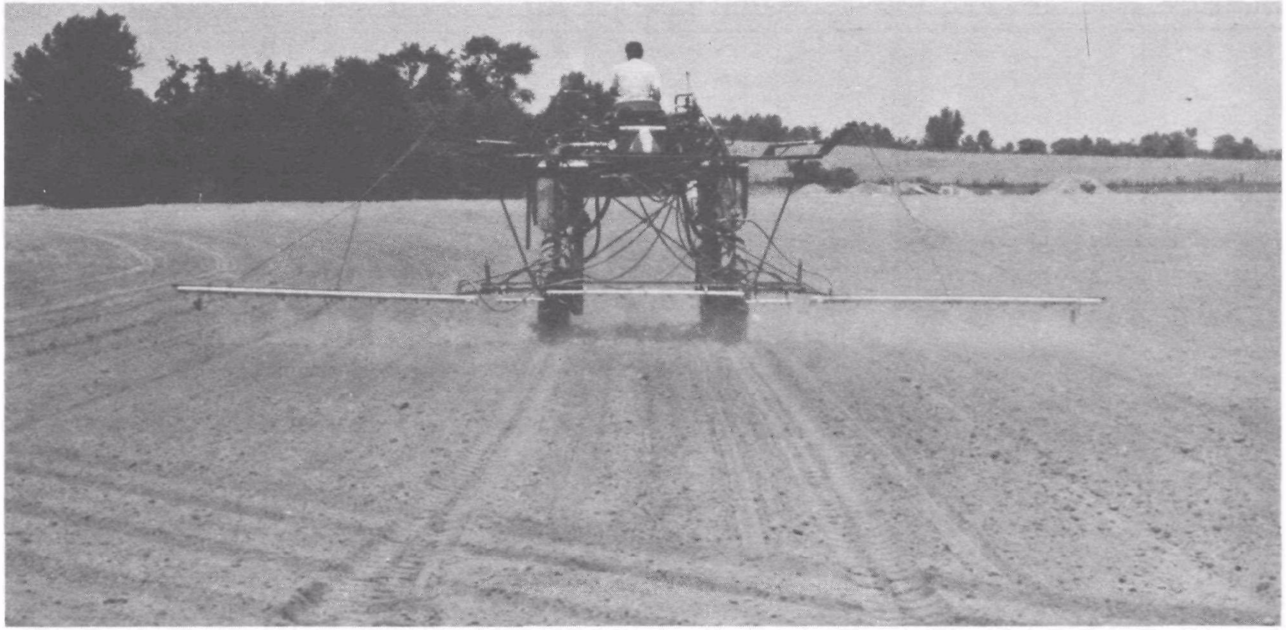


Figure 25. Herbicide application on watershed P1.

TABLE 4. APPLICATION RATES OF HERBICIDES USED ON PLANTING DAY, kg/ha

Watershed	Size, ha	Year	Paraquat*	Diphenamid	Trifluralin	Atrazine	Cyanazine	Propazine	2,4-D
P1	2.70	1972	15.34**	3.36**	1.12**				
		1973	1.53**	3.36**	1.12**				
		1974	2.12†	3.52†	1.12**				
		1975	1.66†					1.66†	
P2	1.30	1973	1.53**			3.36**			
		1974	2.45†			3.81†			
		1975	1.93†			1.54†	1.61†		1.68†
P3	1.26	1972	15.34**	3.36**	1.12**				
		1973	1.53**	3.36**	1.12**				
		1974	1.94†	3.16†	1.12**				
		1975	1.84†	2.31†	1.12**				
P4	1.38	1973	1.53**			3.36**			
		1974	1.93†			4.03†			
		1975	1.75†			1.45†	1.35†		1.55†

*Calculated as paraquat dichloride salt.

**Based on desired application rate.

†Based on filter disc monitoring.

mixed with the wettable powders along with a spreader-activator (Multi-film X=77). The oil base 2,4-D amine was selected to facilitate solution mixing with nitrogen sources.

Mechanical agitation and multiple pumping system controls were designed for a high clearance vehicle to minimize chemical hazards for the operator (Figure 25). Water or urea-ammonia solutions were carefully metered into sprayer tanks with measured pesticides to avoid excessive unused quantities following application to a given watershed. Sprayer equipment was washed in designated areas to avoid runoff and contamination following recommended disposal practices. Group II pesticide container rinses were immediately poured into sprayer tanks. Designated landfills were used for all pesticide container disposal. Protective apparel and equipment were used during pesticide mixing, loading, and application. An effort was made to perform spray operations during periods of low temperature and wind velocities to minimize vaporization and drift.

Pesticide Incorporation, Planting, and Tillage Operations

Using moldboard plows, watershed soils were tilled 20 cm deep during the initial year of each watershed. Soils were chiseled 20 cm deep during subsequent years when necessary to eliminate hardpans or crusted layers. Rotary mowing followed by disc-harrowing was used to incorporate green manure crops (Figures 26 and 27) and routinely applied fertilizers (10- to 15-cm depths). Fresh rye residue (2.0 to 3.0 metric tons per hectare) were incorporated on P3 and P4 annually. A no-tilled sequence of barley and grain sorghum was initiated on watershed P1 during October 1974. Soybeans on P3 were cultivated twice annually during the 1974 to 1975 cropping seasons as was corn on P4 during the 1975 cropping season in an attempt to control excessive weed populations.

The preplant incorporated herbicide (trifluralin) and fertilizers that contained specified quantities of KCl were incorporated with a Lely Roterra (Figure 24). Twenty-two-centimeter, contrarotating tines were mounted to operate 15 cm deep. Preliminary studies showed that about 90 percent of the incorporated herbicide remained in the surface 2.5-cm depth with decreasing amounts to 15 cm. Planter linkage was modified to mount four each on the incorporator. This procedure facilitated pesticide incorporation and crop seeding within 30 minutes following pesticide application. The same spray vehicle was then used to apply preemergence pesticides to the surface immediately following planting (Figure 25).

WATERSHED RUNOFF AND SOIL SAMPLING

Runoff Sampling

Construction and general operation of runoff samplers were described earlier. The volume of runoff in relation to the discharge volume collected by the sampler varied depending on the depth of flow in the flume. Figure 28 shows the relationship established between sample volume and discharge volume using data from selected storms on watershed P4. The discharge volume:sample

Figure 26. Rye cover crop on watershed P3, April 1973.

Figure 27. Incorporated rye plant material on watershed P3, May 1973.

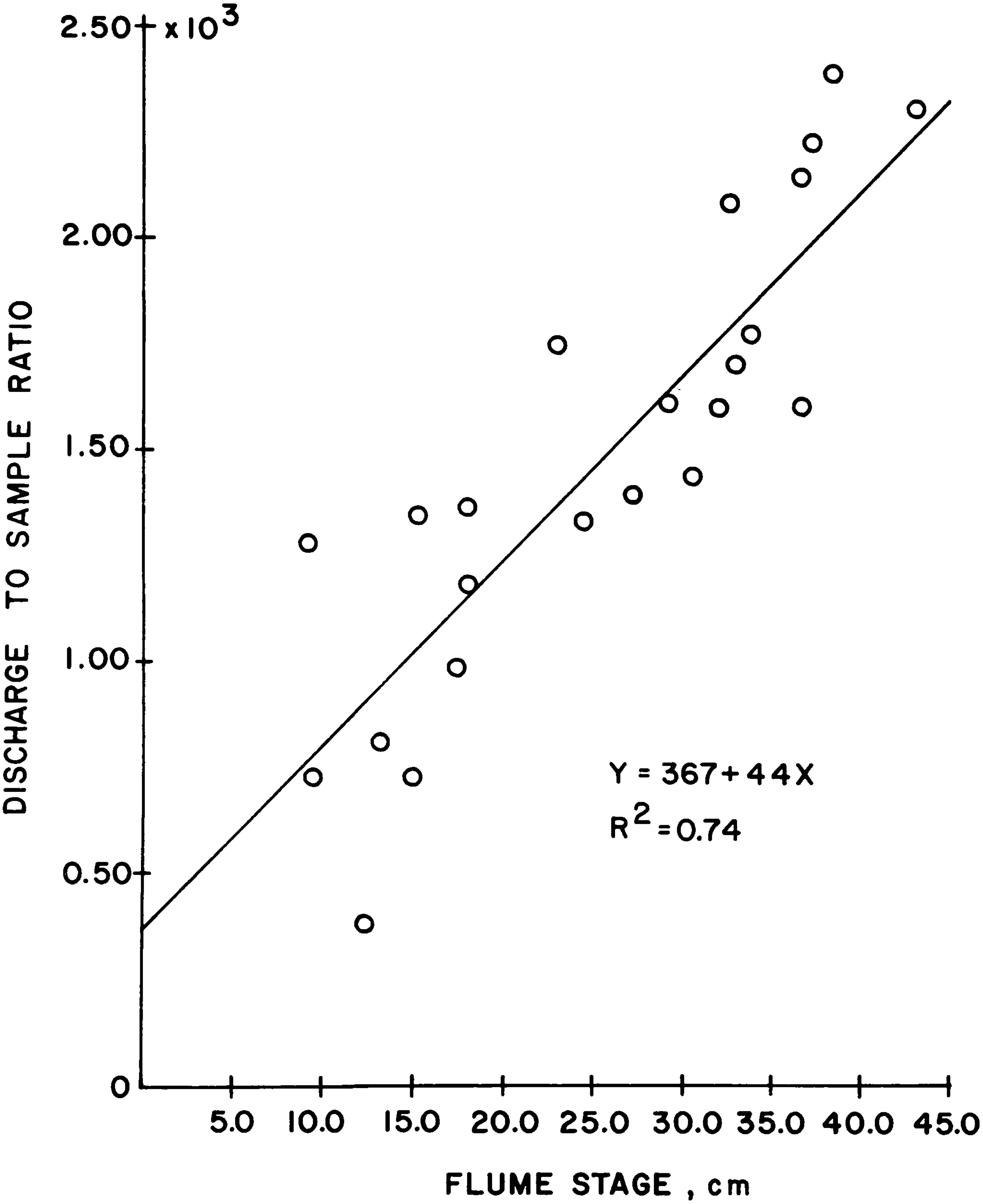


Figure 28. Relationship between flume stage and fraction of flow collected as sample, P4 watershed.

volume ratio is plotted as a function of average stage height during the time required to collect the sample volume of about 9.5 liters. The relationship shows that at low flume stages (0 to 5 cm) the sampler collected about 0.002 of the total flow and about 0.0004 of the total at flume stages of 45 to 50 cm. The sampler was designed to ensure adequate sample volume at low flows or small runoff events and at the same time limit the samples to practical numbers during high flows. Some of the point scatter in Figure 28 is undoubtedly caused by the way in which average flume stage was obtained, that is, arithematic averages of highs and lows. Trash occasionally collecting on the sampling slot also altered the sample rate. Figure 28 is presented only to illustrate sampler performance; the relationship shown was not used as a rating curve from which sample volume or discharge volumes were computed. Discharge volume corresponding to each sample was computed from events marked on the recorders at the beginning and the end of each sampling time interval.

Several storms on P1 and P3 during the first part of the 1972 season were discretely sampled by hand grab samples before the automatic samplers were in operation. Ten-liter samples taken at the flume discharge at 2 to 5 minute intervals were used for physical characterization of the sediment, as well as for pesticide residue analysis.

Runoff samples as collected above were removed from the refrigerated collection facility in the field soon after each runoff event. During the growing season, and in particular after storms that occurred shortly after pesticide application, samples were removed 1 to 4 hours after runoff stopped. Sample containers were covered with a double thickness of heavyweight aluminum foil held securely by a rubber band placed around the foil under the rim of the container to avoid spillage in transport. Samples were stored in a walk-in type refrigerator at 4 °C until further processing.

Within several hours after sample collection from the field, the samples were appropriately subdivided for the various chemical and physical analyses. Each sample, about 9.5 liter in volume, was stirred to resuspend the sediment and poured through a sample splitter especially designed to rapidly subdivide large-volume samples containing sediment. A description of the design and operation of this device has been published.[19] The original samples were subdivided into three representative samples of approximately equal volume. Total sample mass and the mass of each subsample were determined to the nearest gram by weighing using a large-capacity, top-loading balance. One of the subsamples was collected in a 3.8-liter (1 gallon) small-mouth amber glass jug with Teflon-lined cap for pesticide residue analysis and stored at 4 °C. Calcium chloride, added to each glass container prior to collecting the sample, provided sediment flocculation and had no apparent effect on residue extraction. A second subsample was collected in a polyethylene bucket and retained for determination of sediment concentration and sediment characterization. The third subsample was additionally subdivided for chloride, nitrogen, and phosphorus analyses as required. One subsample was pressure filtered through 0.45 micrometer (μm) Nucleopore filter membranes and retained for analysis of water soluble chlorides and plant nutrients. A second unfiltered subsample was retained for analysis of total nitrogen and phosphorus. Both filtered and unfiltered subsamples were rapidly frozen and stored at -10 °C until just prior to chemical analysis.

Soil Sampling

Pesticide Residue--

No single sampling procedure was completely adequate to meet the needs of this study. Caro and Taylor[20] have discussed the difficulties encountered in field sampling for pesticide residues. The project objectives required that frequent samples be taken for characterization of residue on or near the soil surface (in the runoff zone) as a function of time after application and also measurement of pesticide residues with time at several soil depths below the zone of application to provide data on vertical movement.

At the beginning of the study, each watershed was divided into a number of sub-areas or sampling segments. The area delineations were made according to surface topography, soil characteristics, and position on the watershed so that each area would be approximately homogeneous in properties and expected response. The delineations are shown in Figures A2, A4, and A5. Watershed P1 was sampled somewhat differently in 1974 and 1975 from that shown in Figure A5. In 1974 and 1975, areas 8 and 10 were combined into one and designated as area 8.

Except for 1975, most of the soil sampling was accomplished using a conventional small-diameter (approximately 2-cm), split-tube core sampler. Twelve to 15 soil cores were randomly selected from each area and divided into desired depth increments; each increment was composited to give one sample per segment. The samples from individual depth intervals were placed in aluminum cans and mixed thoroughly, and the cans were sealed with plastic tape.

During the 1972 growing season, relatively little soil sampling was done. Two complete sets of samples were obtained for watershed P1 and P3, but no data are reported because the samples were insufficient to adequately characterize pesticide persistence. Also, contamination problems between samples of different depth increments confounded interpretations.

In 1973, 1974, and 1975, soil core samples were taken from the four watersheds before planting and after each runoff event during the growing season. Soil core samples were taken immediately after pesticide application during 1972 and 1973. (Problems encountered in sampling are discussed in the result and discussion section of pesticide persistence and movement.) Sampling depth intervals were 0 to 1, 1 to 2.5, 2.5 to 5, 5 to 7.5, 7.5 to 15, 15 to 22.5, and 22.5 to 30 cm.

In 1975, a large-volume sampler was used to collect samples from the freshly tilled soil immediately after pesticide application and each day thereafter until the first runoff event. Application has been made to patent the surface-soil sampler used (Patent Application, EPA No. WQO-193-76(E)). The stainless steel surface soil sampler consisted of the components shown in Figures 29 and 30. In use, the sampler was pressed into the soil to the desired depth. Soil immediately exterior to the cylinder was then removed and the cutting blade was inserted through the slot and pushed through the soil, serving as a rigid bottom to the cylinder. The soil in the cylinder was then removed, weighed, and blended in a twin-shelled blender. Subsamples were then removed for pesticide residue analysis and soil water determination. Residue or amounts of pesticide remaining were expressed directly on a per-unit-area or volumetric basis using the area and volume of the sampling cylinder rather than on a weight basis or the indirect volumetric basis using soil bulk density for conversion as required when sampling by conventional soil core procedures.

The field sampling design for this large-volume sampling approach differed considerably from that used for small cores. Seven or eight sampling areas per hectare were selected. In general, each sampling site subtended an equal areal fraction of the watershed. No specific attention was paid to soil mapping criteria.

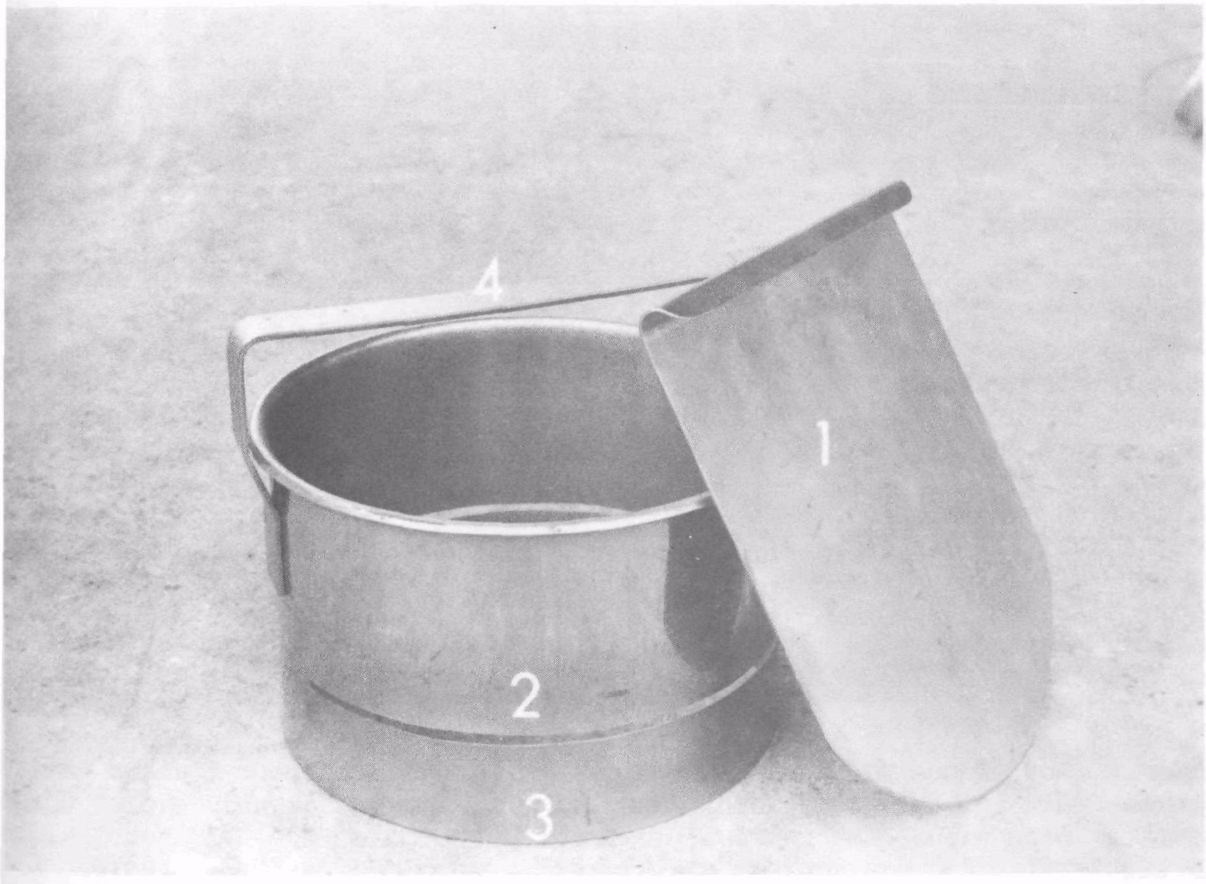


Figure 29. Surface soil sampler: 1 - cutting blade; 2 - cutting blade slot; 3 - tapered cutting edge; and 4 - handle.

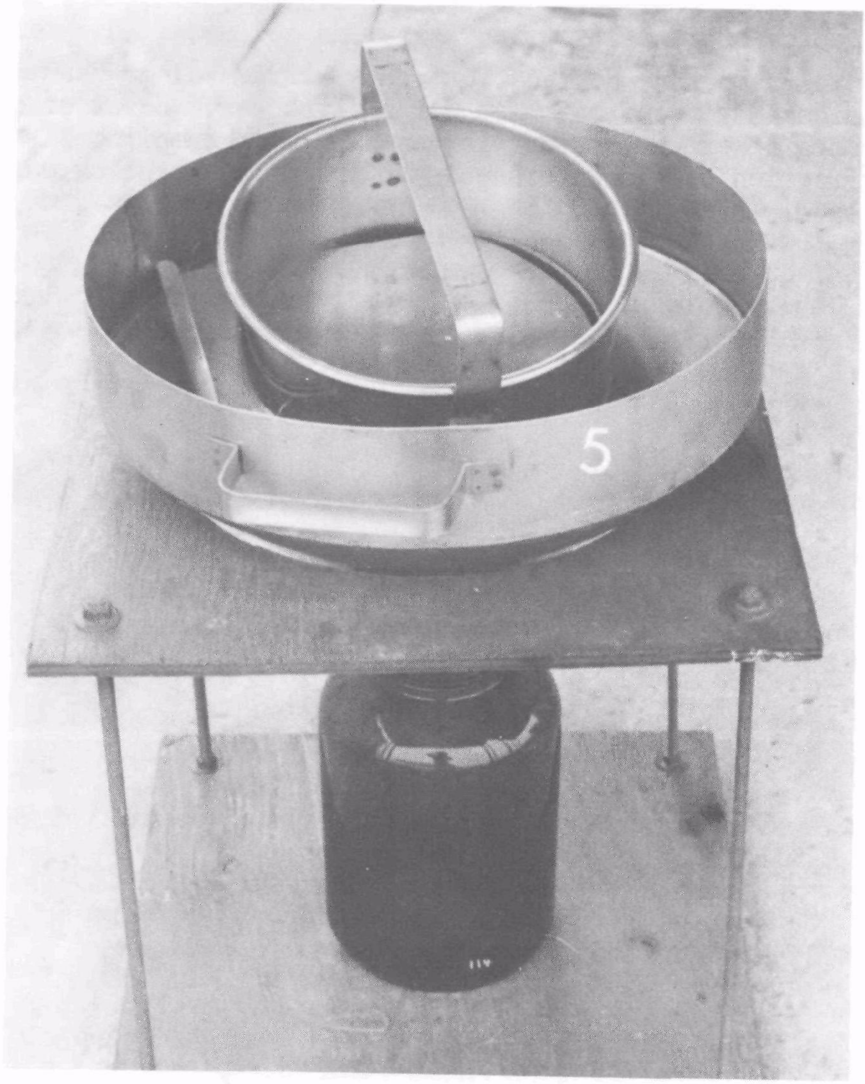


Figure 30. Surface soil sampler, funnel, and support stand.

Every attempt was made to minimize discrepancies between consecutive samples (that is, one day apart) taken from a given area. The sampling pattern within a given sampling area was designed to give the most accurate estimate of attenuation rate free from discrepancies effected by variations in soil characteristics (that is, clod size, texture, etc.) and pesticide application heterogeneity.

The goal for the 1975 cropping season was to obtain 1 week or longer of post-application soil sampling on a daily basis until a rainfall event occurred. P4 watershed was planted first; it rained the first day. Because the rain was not sufficient to produce runoff, three additional days of samples were taken even though the sampling conditions were far from optimal. The sampler itself worked well under moist conditions, but the blending and subsampling operations were severely hampered by excessive moisture. The planting-day samples, however, showed that measurement of applied pesticides by the volume sampler agreed well with the measurement via filter papers (Table 5). Paraquat is an exception; this may be due in part to background, but a whole host of problems are associated with the field monitoring of paraquat. On P2 watershed, seven post-application days without rain gave the "break" needed; after the initial rain, two additional volume sample sets were collected. In addition to monitoring pesticide, on P2, soil moisture and surface soil temperature were recorded at each sampling site. Also, one or more sets of duplicate samples (that is, contiguous samples) were taken each day at a different sampling site. The duplicate sampling, although not an absolute determination of precision, suggested a high level of precision in the monitoring scheme.

Chloride and Plant Nutrient Residue--

Soil cores were collected from watershed P2 at grid intersects as shown in Figure A2. Grid transects 16-21, 28-33, 39-43, 49-51, 57-1 and 1-11 were used so that the watershed was sampled on a 15.2-meter by 30.5-meter grid pattern as well as a 15.2-meter transect down the drainage channel for a total of 32 grid intersects. The P4 watershed was sampled approximately on a 22.9-meter by 30.5-meter grid pattern in terrace intervals (Figure A4) for a total of 21 sampling sites. Core sites were shifted by 1-meter intervals up and down corn rows within annual samplings (5 each) and 1-meter intervals across rows each year. All holes were back-filled with subsoil material from an adjacent area immediately after sampling. This sampling arrangement permitted data grouping by soil units and slope as desired.

A tractor-mounted hydraulic sampler was used to sample to 1.52-meter depths before fertilizer application and throughout the growing season. Sample tubes with 4.3-cm (internal diameter) cutting heads were used to remove soil cores. Each soil core was divided into appropriate depth intervals and transferred to polyethylene bags. The soil was then mixed and crushed by applying hand pressure on the bags. Subsamples were removed for determination of water content. Complete soil depth intervals and dates are given in Tables C22 through C35.

Subsamples for Cl and NO_3-N analyses were weighed moist and transferred to 125-ml Erlenmeyer flasks immediately following sampling. Weights were

TABLE 5. HERBICIDE APPLICATION RATES AS MONITORED BY VARIOUS TECHNIQUES (kg/ha), 1975

Watershed	Sample type	Atrazine	Cyanazine	2,4-D	Paraquat	Diphenamid	Propazine
P1	Filter disc	NA*	NA	NA	1.66	NA	1.66
	Nozzle (timing)				1.29		1.78
	Surface soil sampler						
P2	Filter disc	1.54	1.61	1.68	1.93	NA	NA
	Nozzle (timing)	1.65	1.44	1.12	1.96		
	Surface soil sampler	1.33	1.26		2.00		
P3	Filter disc	NA	NA	NA	1.84	2.31	NA
	Nozzle (timing)				1.45	3.36	
	Surface soil sampler						
P4	Filter disc	1.45	1.35	1.55	1.75	NA	NA
	Nozzle (timing)	1.81	1.55	0.86	0.86		
	Surface soil sampler	1.55	1.52		3.70		

*NA = Not applied.

corrected for water content as determined on the above sub-samples. Samples for analysis were frozen until extraction. Other analyses were determined on air-dried soil samples screened through a 2.0-mm sieve.

Pesticide Application Rates

Certain inherent variations and difficulties are present in pesticide application using conventional farm equipment. In following pesticide persistence with time after application, it was important to know as accurately as possible the amount of pesticide actually applied or reaching the soil surface. In 1972 and 1973, it was hoped that intended or target application rates could be verified from analysis of soil samples taken by the split-tube soil core procedure described previously; however, the variability in sampling of the freshly tilled soil precluded this. Composited samples of the soil surface taken at many points over the watershed using a spatula also were inadequate to verify application rates.

In 1974, pesticide application was monitored using paper discs randomly placed throughout the watersheds to intercept the spray application. Approximately fifty 18.5-cm Whatman Number 42 filter pads per hectare were placed over the watershed in the sprayer path. Pesticide penetration through one layer of filter pads had been determined previously to be negligible. As soon as the sprayer had passed over the pads, they were collected, composited, and removed to the laboratory for extraction and analysis. The rates found by this procedure appear in Table 4.

Spray application rates were also monitored by timing the sprayer during application and recording total spray time. Samples of the spray at the nozzle were collected for delivery rate per unit time (see Table 5).

ANALYTICAL METHODOLOGY

Physiochemical Characterization of Soil, Sediment and Runoff

Runoff samples for sediment analysis were acidified in polyethylene buckets with a few drops H_2SO_4 to about pH 3 to 4 to promote flocculation of the suspended sediment. The clear supernatant was removed and discarded and the sediment was air-dried. The dried sediment was removed, weighed, and stored for later use. The sediment concentration in the original runoff sample was computed knowing the sediment weight and the volume (mass) of the runoff sample.

Particle size distribution, surface area, and organic carbon content were determined on sediment samples from selected runoff events. Similar analyses were also conducted on composite soil samples from each of the sampling areas of the watershed as shown in Figures A2, A4, and A5. Particle size distribution was determined by the hydrometer method,[21] except that dispersion was accomplished using ultrasonic vibration.[22] Organic matter was determined by wet oxidation and potentiometric titration.[23,24] Specific surface area was determined by N_2 gas desorption,[25,26] which measures external surfaces only. This method was chosen as an indicator of total adsorptive capacity because of its rapidity and reproducibility and small sample requirement. Non-expanding clay minerals were predominant in the watershed soils. In preliminary comparative studies of methods, total surface area determined by an ethylene glycol monoethyl ether procedure[27] gave values averaging about three times those of the N_2 desorption procedure.

<u>Pesticide Residue Analysis in Soil, Sediment, and Runoff</u>

During the project planning stage, it was anticipated that large numbers of runoff and soil core samples would be collected for chemical analysis. After planting, runoff samples were analyzed from each event until the parent pesticide decreased in concentration to a level (depending upon the compound) below the detectable range of the measuring instrument. Each runoff sample received was recorded, a laboratory number assigned, and the samples placed under refrigeration at 4 ^{o}C pending analysis.

Soil core samples for persistence and mass balance computations were obtained after runoff events Each core sample was recorded, a laboratory number assigned, and placed in a freezer at -18 ^{o}C pending analysis. All core data were reported on a moisture free basis.

An analytical method was needed to analyze the parent pesticides in runoff (water and sediment) and soils at a minimum sensitivity in the low parts per million (ppm) for paraquat and the low parts per billion (ppb) for trifluralin and diphenamid. "Production line" analysis was necessary to provide a large sample throughput in a minimum amount of time. In addition, a rapid analytical procedure would reduce the risk of trifluralin loss by volatilization and degradation.

An integrated method fulfilling these requirements was developed.[28,29] This method was later used for the herbicides atrazine, propazine, and cyanazine. These compounds, however, required adjustment of the soil moisture to at least 20 percent to ensure efficient extraction.

2,4-D was analyzed by a modification of the method of Woodham <u>et al.</u>[30] as follows: Residues of 2,4-D were determined in soil, sediment, and water by solvent extraction, acidification, and esterification to the methyl exter using diazomethane. The amount of the acid herbicide present was determined by electron capture gas chromatography. A series of 2,4-D fortified soil and water samples as the free acid were analyzed using the final method. Recoveries run in replicate ranged from 96.7 to 98.4 percent in soil and water.

Fortified soil and water samples using the 2,4-D formulation (dacamine) consistently ranged from 87 to 91 percent recovery on duplicates ranging from 2 ppb to 400 ppm. This broad range of levels was run to assure that the length of reaction time of the herbicide with the esterifying reagent and the amount of reagent used would not affect the increase or decrease of the ester recovery. Interferences from soil extractions were eliminated by a H_2O/CH_2Cl_2 shakeout of the acetone/soil extract at the time of acidification. The CH_2Cl_2 extract was evaporated to 1 to 2 ml and transferred to 15-ml conical centrifuge tubes. The remaining CH_2Cl_2 was evaporated just to dryness, and 2 to 3 ml of ether was added at the time of esterification. Fortified samples and 2,4-D standards were run as controls with each set of 20 samples extracted and esterified.

The analyses were performed by using a Tracor MT-220 gas chromatograph equipped with a Coulson electrolytic conductivity detector operating in the nitrogen mode. Colorimetric determinations of paraquat were made by using a Perkin-Elmer Model 202 recording spectrophotometer equipped with an auxiliary recorder and scale expansion accessory.

Chloride and Plant Nutrient in Soil and Runoff

Soil and runoff samples were stored at -10 °C until ready for extraction. Subsamples of unfiltered runoff were stored at -10 °C and the remaining subsamples were filtered through a 0.60-µm Nucleopore membrane and the filtrate stored at -10 °C. Sediment was not analyzed separately because sediment concentrations in runoff were occasionally so low that collection of an adequate sample by filtration was impractical.

Nutrients were extracted from the frozen soil and runoff samples by placing a 5-gram sample of the frozen material into a 125-ml Erlenmeyer flask with 50 ml of distilled water and shaking the suspension for 1 hour on a wrist-action shaker. Sample weights were corrected for water content from values determined on separate samples taken during the initial sampling (see Table C22 through C35). The suspension was filtered through Whatman Number 41 filter paper, and the filtrate was returned to storage at -10 °C until analysis.

Chemical analysis was later accomplished by allowing the frozen test solution to equilibrate to room temperature before proceeding with the selected automated procedures. Technicon auto-analyzer procedures were used exclusively, varying analytical manifold configurations, reaction solutions, and absorption cell lengths as required to give the required sensitivity in the particular colorimetric method.[31-35]

Nitrate-N and Chloride--

Nitrates and chloride were determined on a dual channel system using the ferric-mercuric thiocyanate color complex for chlorides and the cadmium reduction procedure for nitrates.

Ortho-phosphorus--

Filtered runoff samples were analyzed for ortho-P using the phosphomolybdenum-ascorbic acid blue color complex. Values reported as ortho-P are often referred to as molybolate reaction phosphorus (MRP).

NH_3-N--

Ammonia was determined in the filtered and unfiltered runoff samples using the Berthelot color reaction. Differences between the filtered and unfiltered samples are assumed to represent exchangeable NH_3-N and reactive amines displaced from the particulate phase in the alkaline medium.

Total Kjeldahl Nitrogen (TKN)--

Filtered and unfiltered runoff samples were predigested in a Technicon BD-40 block digestor with subsequent measurement of the ammonia produced. The quantitation of ammonia was achieved by the Berthelot reaction.

Total Phosphorus--

Phosphorus in the filtered runoff samples was hydrolyzed with ammonium persulfate and sulfuric acid in a pressure cooker at one bar for 30 minutes prior to colorimetric determination of P. The unfiltered samples were digested in a mixture of 1:4 ($HClO_4$:HNO_3) acid until fumes of $HClO_4$ appeared. The residue was then taken up in distilled water and analyzed for total P.

Acid Extractable Phosphorus (Available P)--

Available soil P was extracted with a double acid (0.05N HCl in 0.025N H_2SO_4) solution and determined colorimetrically.[36]

DATA REDUCTION, PROCESSING, AND COMPUTATIONS

A data management system was established at Athens ERL to compile and record data from this study and related projects. Figure 31 illustrates the general data flow and computations required. Listed in Table 6 is a description of software programs required. Examples of data input and computed output along with descriptions of computations is given in Appendix D.

Rainfall-Runoff Records

Rainfall and runoff records were tabulated from field charts recording values versus time at inflection points in the continuous chart traces (break-point method). These data along with sample times, sediment concentrations, and chemical residue data, if applicable, were transferred to cards for machine processing.

Stage height versus time at 1-minute intervals was generated from the runoff records using linear interpolations between break-points. Conversion tables from Handbook Number 224[16] were stored internally for conversion of stage height to discharge rate. For stage heights intermediate to those listed, a cubic approximation was used to generate the conversion function. Flow versus time was then computed at 1-minute intervals throughout the runoff event. Mass of sediment and chemicals in runoff was computed from input concentration and sample times, using the flow volume between successive sample times. Any runoff recorded after the last sample in an event was added to the last sample volume for computational purposes. Runoff volumes and rates were output at each input stage height and sample time. Sediment and chemical mass were also output for each sampling increment of time. Storm

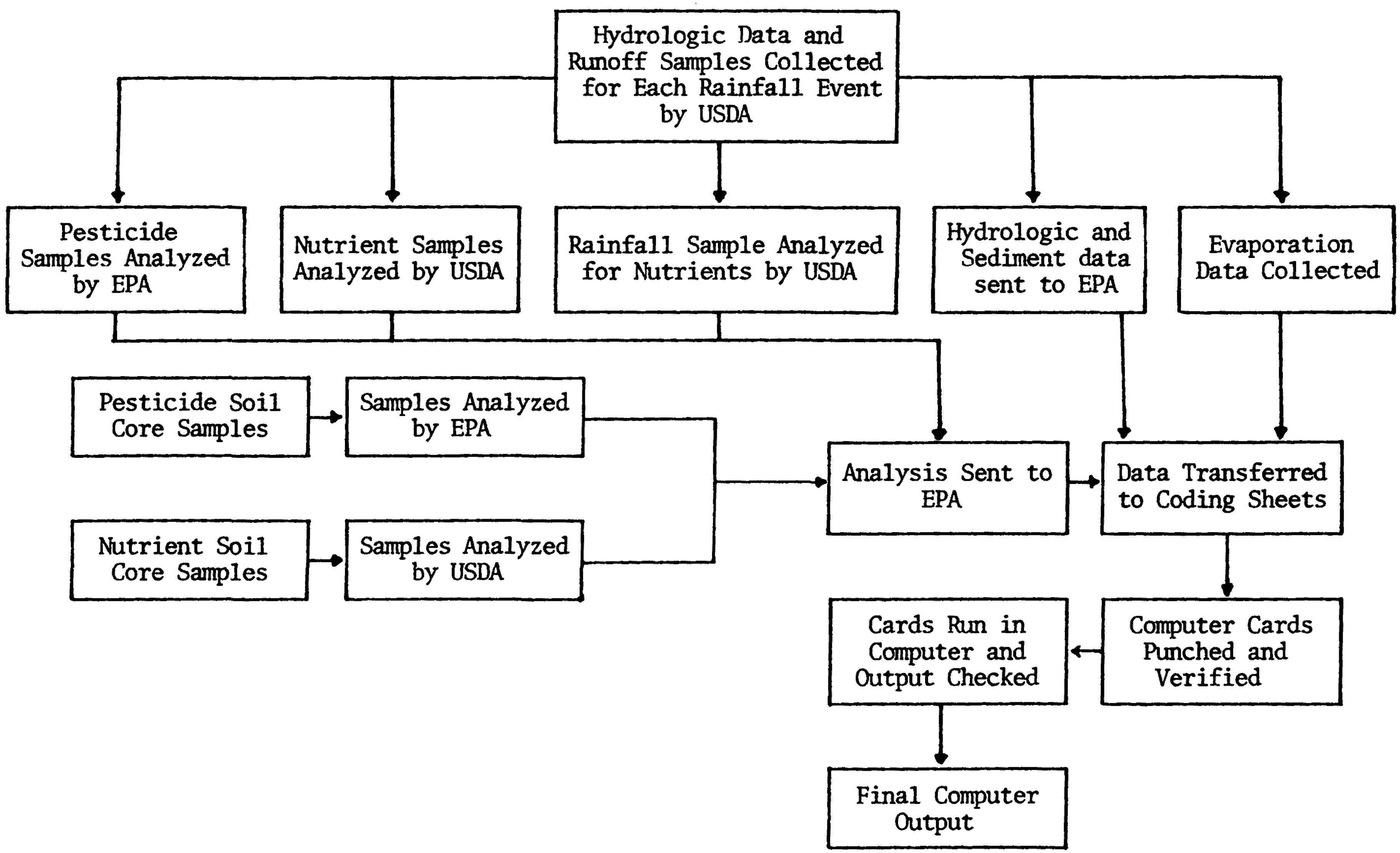


Figure 31. Data flow and computations.

TABLE 6. COMPUTER PROGRAMS REQUIRED FOR STUDY

Program	Required input	Output
Runoff	Descrete observations and sampling times of: 1. Rainfall (inches) 2. State height (ft) 3. Sediment loss (g/l) 4. rainfall nutrient conc. (μg/l) 5. Runoff nutrient conc. (mg/l)* a. Dissolved b. Adsorbed on sediment 6. Runoff pesticide conc. (μg/l)* a. Dissolved b. Adsorbed on sediment	1. Elapsed time 2. Stage height (cm) 3. Flow (l/min) 4. Volume (l) 5. Sediment mass in sample (g/l) 6. Sediment mass in sample interval (kg) 7. Nutrient and/or pesticide mass in sample (mg) a. Dissolved b. Adsorbed on sediment Event summary of: 1. Total runoff volume (l) 2. Total sediment loss (kg) 3. Total nutrient loss (g) a. Dissolved b. Adsorbed on sediment 4. Total pesticide loss (mg) a. Dissolved b. Adsorbed on sediment 5. Mean concentrations a. Sediment (g/l) b. Nutrient (mg/l) c. Pesticides (μg/l) 6. Net gain or loss of watershed nutrients (g)
Soil core†	Pesticide: 1. Pesticide concentration for each sampling depth zone (ng/g): 0-1, 1-2.5, 2.5-5, 5-7.5, 7.5-15, 15-22.5, 22.5-30 cm Nutrient: 1. Nutrient concentration for each sampling depth zone (ng/g): 0-3, 3-6 6-12, 12-18, 18-24, 24-36, 36-48, 48-60 inches	Pesticide: 1. Grams pesticide/segment/depth 2. Total grams/depth zone 3. Pesticide concentration (μg/kg)/depth zone Nutrient: 1. Average concentration (ng/g)/depth zone 2. Grams of nutrient/depth zone

*Not all nutrients and pesticides have dissolved and adsorbed forms.

†Bulk density assumed constant at 1.6 g/cm^3.

totals and average chemical concentrations were also output along with other data. Summaries of each event are given in Tables E1 through E36 for pesticides and Tables H1 through H24 for plant nutrients. Plant nutrients were determined in filtered and unfiltered samples because of small sediment quantities. Values for sediment N and P were generated by assigning the concentration differences between filtered and unfiltered samples to the sediment phase. Sediment concentration values were used to compute mass on a per unit sediment basis.

Soil Data

Soil samples obtained from the watershed at selected times throughout the study provided data on pesticide persistence, downward movement of Cl, and NO_3^-N contents of the watershed soils. Most of the soil samples were removed as cores and chemical analyses were obtained on a dry soil weight basis. Certain bulk density values were assumed in converting to a volume or area basis. The bulk density of freshly tilled soil was substantially less than that after crusting and settling subsequent to the first intense rainstorm, that is, about 1.2 gram per cubic centimeter (g/cm^3) for freshly tilled soil compared to about 1.6 g/cm^3 for compacted soil. However, the 1.6 g/cm^3 value was used for all computations. Summaries of pesticide concentrations on the watersheds with time and depth are shown in Tables G1 through G29. Average concentrations and mass of plant nutrients with depth and time are shown in Tables F1 through F10.

SECTION 7

RESULTS AND DISCUSSION

CROP PERFORMANCE AND CANOPY DEVELOPMENT

Weather data suggest that considerable water stresses occurred to the plants, particularly during the summer nonvegetative growth stages. Generally, water stresses were moderate to severe during the 1972 to 1973 crop years, moderate during 1974 (Figure 32), and low during 1975 (Figures 33, 34, 35, and 36). Plant canopies and grain yields reflect these climatic variations. Plant height and width measurements were made in 1973, 1974, and 1975 at selected intervals (see Tables 7, 8, and 9). Mean soybean yields varied from 1000 to 2000 kg/ha and corn from 2200 to 5400 kg/ha (Table 10). Crop yields (Table 11) are indicative of variable soil types and slopes occurring on the watersheds. For example, watershed P2 sampling areas 8, 9, and 10 occur on alluvial and overwash soil, which provided a more favorable water regime during the growing season. Good crop yields are associated with these areas; whereas, near crop failures may be experienced on eroded areas similar to areas 1 and 3. Standard errors of means suggest far less variation on watershed P4. Barley yields were 2800 kg/ha and grain sorghum 7500 kg/ha on watershed P1 during 1975 (Table 10). Barley and rye consistantly provided good winter crop canopies and soil mulch (Figures 26 and 36). However (as observed in this project), Southern Piedmont lands often erode severely following conventional tillage procedures without conservation measures (Figures 37 and 38).

Weed problems occurred on watersheds P1, and P3, and P4 during the 1973 and 1974 summer cropping seasons (Table 12). This problem was almost eliminated during the 1975 cropping season with no-till planting associated with alternate herbicides on P1 and cultivation on P3 and P4. Winter weeds on watershed P2 provided some soil cover during winter months.

WATERSHED HYDROLOGY

Rainfall, runoff, and sediment yield over the entire study period are summarized in Figures 39 through 42. A complete listing by rainfall event is given in Table C1 through C14. This study period, however, is insufficient to make frequency analyses on rainfall and runoff and comparisons between watersheds. The observations of this study are, in general, consistent with other studies in the Piedmont.[11,37,38]

Figure 32. Incomplete soybean canopy on watershed P3, August 1973.

Figure 33. Complete soybean canopy cover on watershed P3, August 1975.

Figure 34. Complete corn canopy on watershed P2, August 1975.

Figure 35. Complete corn canopy on watershed P4, August 1975.

Figure 36. Barley residue mulch under grain sorghum canopy on watershed P1, July 1975.

Table 13 summarizes rainfall-runoff results over complete calendar years within the study period, that is, 1 July 1972 to 30 June 1975 for P1 and P3 and 1 July 1973 to 30 June 1975 for P2 and P4. Rainfall, runoff, and percentage runoff for the years are summed by quarters. The amount of rainfall was fairly uniform for the corresponding quarter of each year throughout the years except for the fall quarter of each year which was somewhat less. Runoff, however, tended to be significantly higher in spring and summer. This reflects the nature of the rainfall events; spring and summer rainfall occurring mainly as thunderstorms with fall and winter rainfall more of the frontal, long duration, low intensity type. The watersheds responded very rapidly in producing runoff from thunderstorms (see Figures 43 and 45). Although hydrographs from P2 and P4 are not shown here, runoff from these watersheds during thunderstorms was also rapid but with the runoff peaks being somewhat delayed and attenuated on P4 because of differences in land form and the presence of conservation structures.

Soil water data from all four watersheds taken at selected times throughout the study are given in Tables C15 through C35. Pan evaporation is given in Tables C36 through C39. Potential evapotranspiration exceeds rainfall throughout most of the summer months. The soil-water data show a depletion of water to considerable depths in the profile as summer progresses. Soil water storage capacity rarely becomes limited in summer; therefore, thunderstorm runoff reflects a surface phenomena whereby infiltration through the surface few cm becomes limiting.

TABLE 7. CANOPY DEVELOPMENT ON WATERSHEDS, 1973 GROWING SEASON

Watershed	Crop	Date of planting	Date	Days after planting	Average plant height, cm	Average plant width, cm
P1	Soybeans	06-13-73	07-18-73	35	44	40
			07-26-73	43	52	43
			08-08-73	57	77	46
			09-12-73	92	96	59
P2	Corn	05-11-73	07-11-73	61	198	
			07-26-73	76	274	
P3	Soybeans	06-15-73	07-20-73	35	44	33
			07-26-73	41	61	45
			08-08-73	55	85	40
			09-12-73	90	91	43
P4	Corn	05-11-73	06-12-73	32	35	
			07-10-73	60	198	
			07-26-73	76	274	

TABLE 8. CANOPY DEVELOPMENT ON WATERSHEDS, 1974 GROWING SEASON

Watershed	Crop	Date of planting	Date	Days after planting	Average plant height, cm	Average plant width, cm
P1	Soybeans	05-30-74	06-12-74	13	7	
			06-27-74	28	20	19
			07-09-74	40	39	34
			07-15-74	46	53	44
			07-25-74	56	56	51
			07-31-74	62	71	60
			08-14-74	76	85	72
			08-22-74	84	86	75
			08-30-74	92	87	71
			09-09-74	102	91	68
P2	Corn	04-29-74	05-05-74	6	2	
			05-08-74	9	7	
			05-13-74	14	5	
			05-20-74	21	20	
			06-05-74	37	58	44
			06-27-74	59	154	131
			07-15-74	77	206	114
			07-26-74	88	204	112
			08-14-74	107	214	
P3	Soybeans	05-30-74	06-12-74	13	7	
			06-27-74	28	18	20
			07-15-74	46	46	39
			07-25-74	56	64	56
			07-31-74	62	67	53
			08-14-74	76	73	62
			08-22-74	84	78	70
			08-30-74	92	84	77
			09-09-74	102	84	73
P4	Corn	04-29-74	05-21-74	22	20	
			06-05-74	37	51	32
			06-22-74	59	147	133
			07-15-74	77	266	132
			07-25-74	87	254	119
			08-14-74	107	268	

TABLE 9. CANOPY DEVELOPMENT ON WATERSHEDS, 1975 GROWING SEASON

Watershed	Crop	Date of planting	Date	Days after planting	Average plant height, cm	Average plant width, cm
P1	Grain sorghum	06-02-75	07-10-75	38	64	36
			07-28-75	56	128	109
			08-14-75	73	159	91
			08-21-75	80	173	97
			08-29-75	88	185	90
			09-02-75	92	180	97
			09-19-75	109	182	94
P2	Corn	05-21-75	06-23-75	33	69	74
			07-03-75	43	144	133
			07-10-75	50	176	140
			07-28-75	68	245	130
			08-14-75	85	271	132
			08-21-75	92	253	107
			08-29-75	100	239	69
			09-02-75	104	234	60
			09-19-75	121	103	53
P3	Soybeans	05-28-75	06-23-75	26	19	17
			07-03-75	36	37	36
			07-10-75	43	51	48
			07-29-75	61	83	74
			08-14-75	78	105	77
			08-21-75	85	109	90
			08-29-75	93	119	86
			09-02-75	97	115	84
			09-19-75	114	114	Full canopy
P4	Corn	05-14-75	06-23-75	40	81	76
			07-03-75	50	160	132
			07-10-75	60	185	150
			07-29-75	75	251	122
			08-14-75	92	270	110
			08-21-75	99	258	112
			08-29-75	107	255	84
			09-02-75	111	251	76
			09-19-75	128	227	52

TABLE 10. AVERAGE GRAIN YIELDS FOR WATERSHEDS, kg/ha

Harvest date	Watershed P1	P2	P3	P4
12-03-72	1080*		1280*	
10-29-73		2234†		2967†
11-07-73			1410*	
11-19-73	1030*			
09-16-74		4060†		4840†
10-18-74	1570*		1680*	
05-23-75	2800‡			
10-03-75		5400†		5190†
10-24-75	7524§		2020*	

*Soybeans

†Corn

‡Barley

§Grain sorghum

Soil storage capacity is much more likely to become a factor limiting water intake during winter and early spring. Rainfall is high, evapotranspiration (ET) is low, and the entire profile above some limiting layer becomes saturated. In the Cecil and similar soils, the B2 horizon under prolonged rainfall becomes the limiting layer for water intake.[15] Throughout this study, watershed P4 consistently yielded more water in winter and early spring months than did P3 (Table 13). No measurements of subsoil hydraulic conductivity have been made; however, the watershed was somewhat more eroded than P3, the B2 horizon being closer to the surface and more admixed with the surface material in the Ap horizon. As judged by soil core sampling, the B horizon on P4 was physically tighter and more sticky than that on the other watersheds. These observations are consistent with the differences observed in runoff. As shown in another section of this report, movement of NO_3 and Cl through the soil profile on P4 was retarded compared with movement through soils on P2.

This is, of necessity, a very cursory discussion of watershed hydrology. Discussions separating thunderstorm response and wintertime conditions is an oversimplification. At times, preceding frontal passage, severe thunderstorms occur in winter months. The watershed then responded as rapidly as in summer.

Also, some rainfall in summer months did occur in periods of frequent showers maintaining high soil water for several days.

Watershed P2, especially, contains geomorphic variability that affects surface and subsurface hydrology. Soil water contents given in Tables C22 through C34 reflect this variability. In another section of this report,

TABLE 11. CORN GRAIN YIELDS ON WATERSHEDS P2 AND P4, kg/ha

Sampling area	1973	1974	1975	Mean, $\bar{x}$
Watershed P2				
1	583	1664	3210	1819
2	2997	3593	4759	3783
3	539	252	2748	1180
4	2401	4513	6308	4407
5	1267	4273	5483	3674
6	107	1078	3622	1602
7	1593	1629	3479	2234
8	2063	6846	8762	5890
9	5016	9108	7044	7056
10	5775	7643	8681	7366
Mean, $\bar{x}$	2234	4060	5410	3901
SE	600	952	704	(62.2)
Watershed P4				
1	3249	2989	3059	3099
2	2835	5703	4967	4502
3	3280	3288	3478	3349
4	3550	4003	5768	4440
5	3487	6324	5918	5243
6	2390	4530	5893	4271
7	3343	7420	6056	5606
8	2051	6084	5856	4647
9	2521	3223	5799	3848
Mean, $\bar{x}$	2967	4840	5194	4334
SE	179	532	380	(69.1)

Figure 37. Soil erosion in sprayer vehicle tracks on watershed P2, May 1973.

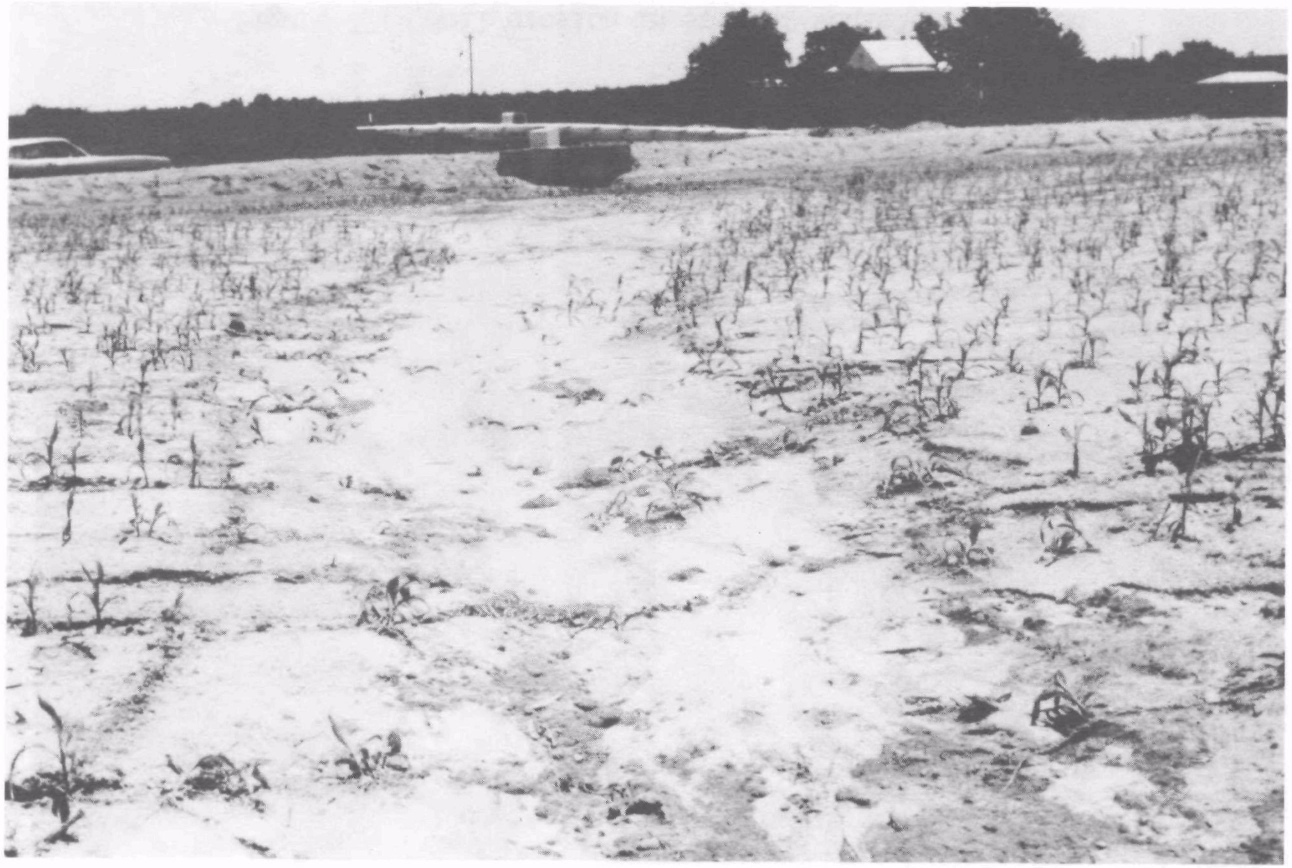


Figure 38. Soil erosion in drainage channel above flume, watershed P2, May 1973.

TABLE 12. WEEDS NOT ADEQUATELY CONTROLLED BY HERBICIDES*

Watershed	Growth period: Summer	Growth period: Winter-Spring
P1	Jimson weed (*Dutura stramonium*)	
P2		Chickweed (*Stellaria media*)
P3	Cocklebur (*Xanthium* spp.)	
	Morning-glory (*Ipomea hederacea*)	
	Sicklepod (*Cassia obtusifolia*)	
P4	Johnsongrass (*Sorghum halapense*)	
	Sicklepod (*Cassia obtusifolia*)	

*By visual observations.

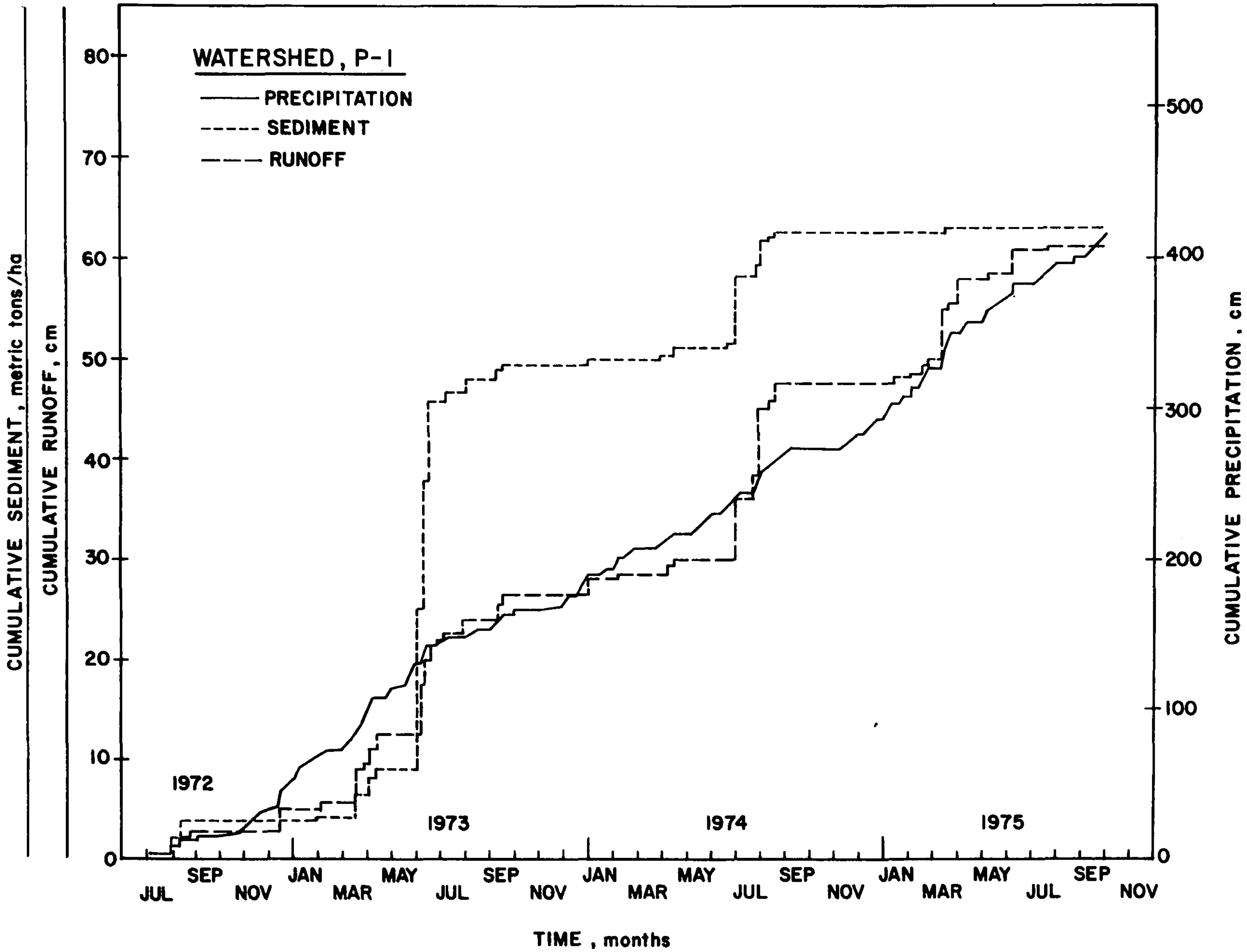


Figure 39. Cumulative rainfall, runoff, and sediment yield during study period, watershed P1.

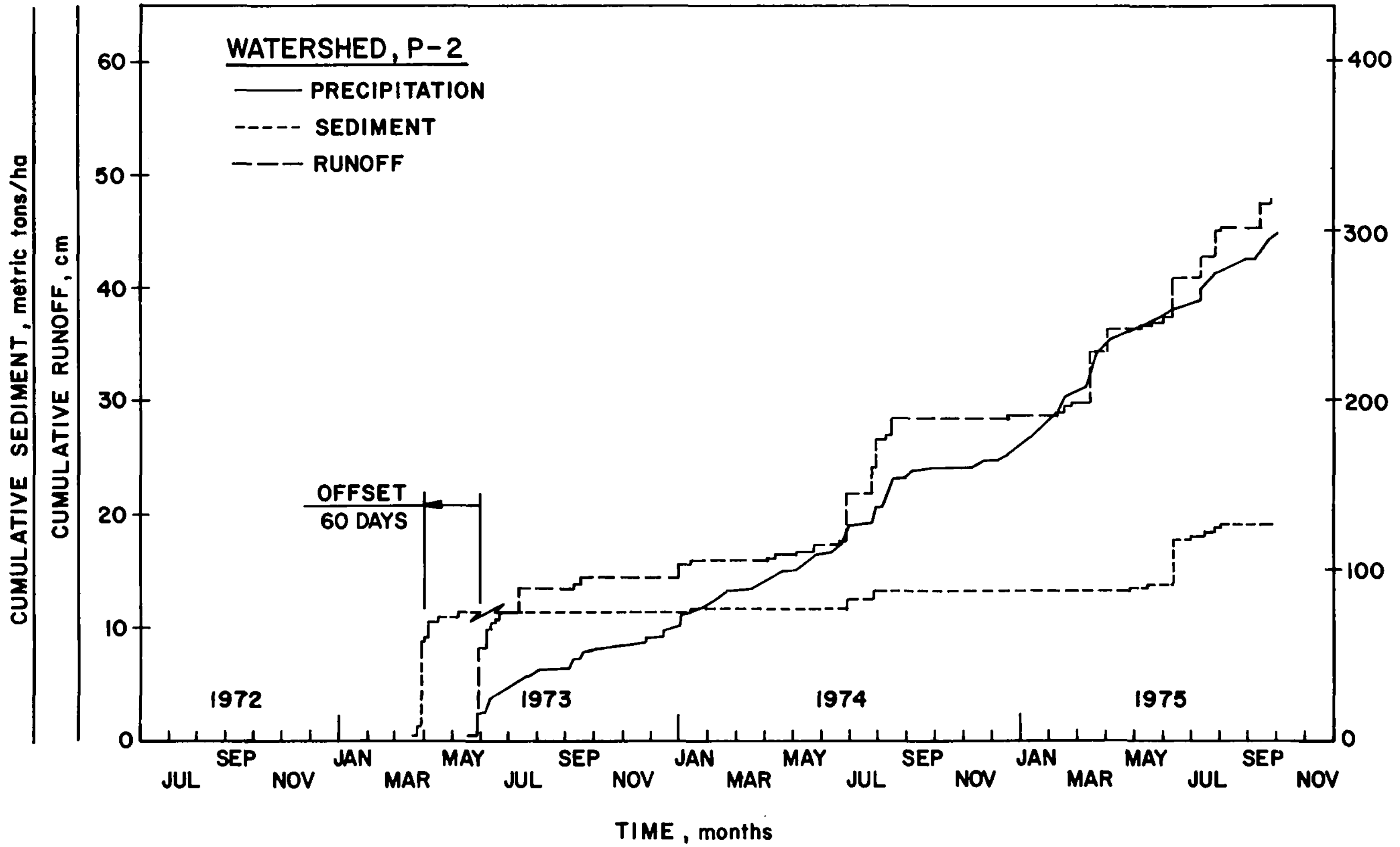


Figure 40. Cumulative rainfall, runoff, and sediment yield during study period, watershed P2.

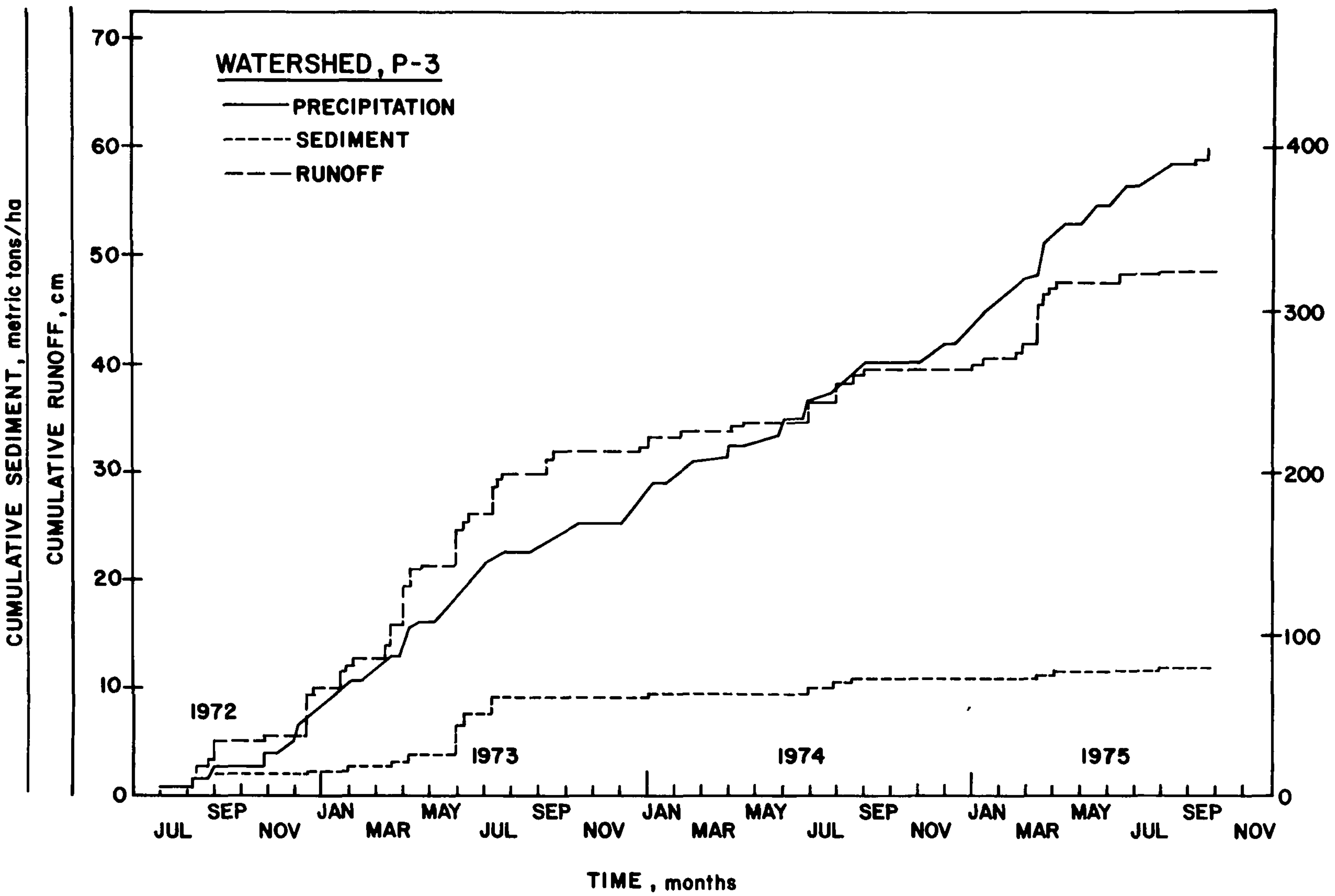


Figure 41. Cumulative rainfall, runoff, and sediment yield during study period, watershed P3.

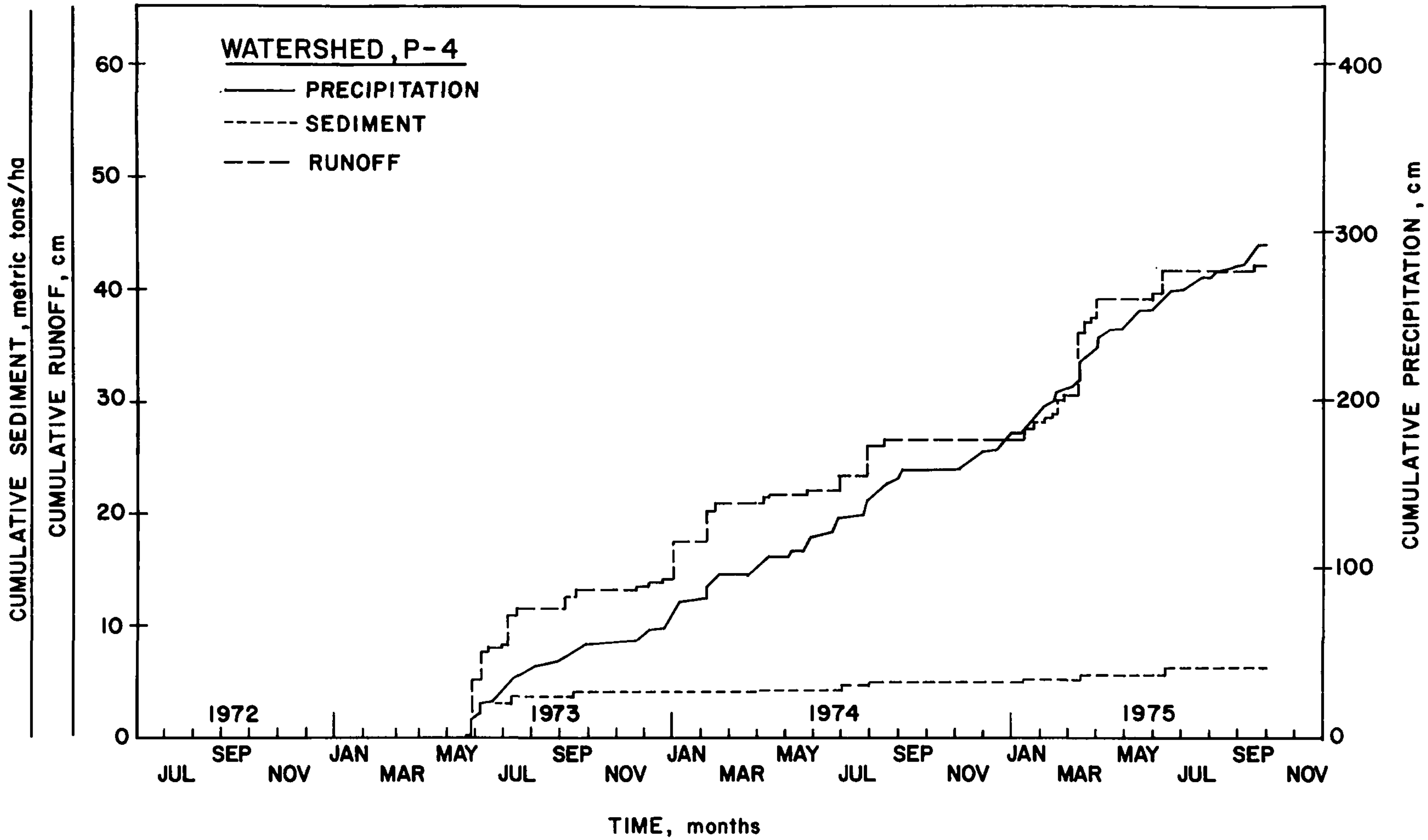


Figure 42. Cumulative rainfall, runoff, and sediment yield during study period, watershed P4.

TABLE 13. QUARTERLY SUMMARY OF RAINFALL AND RUNOFF FROM STUDY WATERSHEDS

Watershed	Jan, Feb, Mar	Apr, May, Jun	Jul, Aug, Sep	Oct, Nov, Dec
P1*				
Rainfall, cm	124	106	70	80
Runoff, cm	15	24	19	4
Percentage runoff	12	23	27	5
P2†				
Rainfall, cm	78	68	53	37
Runoff, cm	8	11	10	1
Percentage runoff	10	16	19	3
P3*				
Rainfall, cm	115	105	75	78
Runoff, cm	17	11	14	6
Percentage runoff	7	10	19	8
P4†				
Rainfall, cm	74	64	57	43
Runoff, cm	14	7	9	5
Percentage runoff	19	11	16	12

*July 1972 to July 1975.

†July 1973 to July 1975.

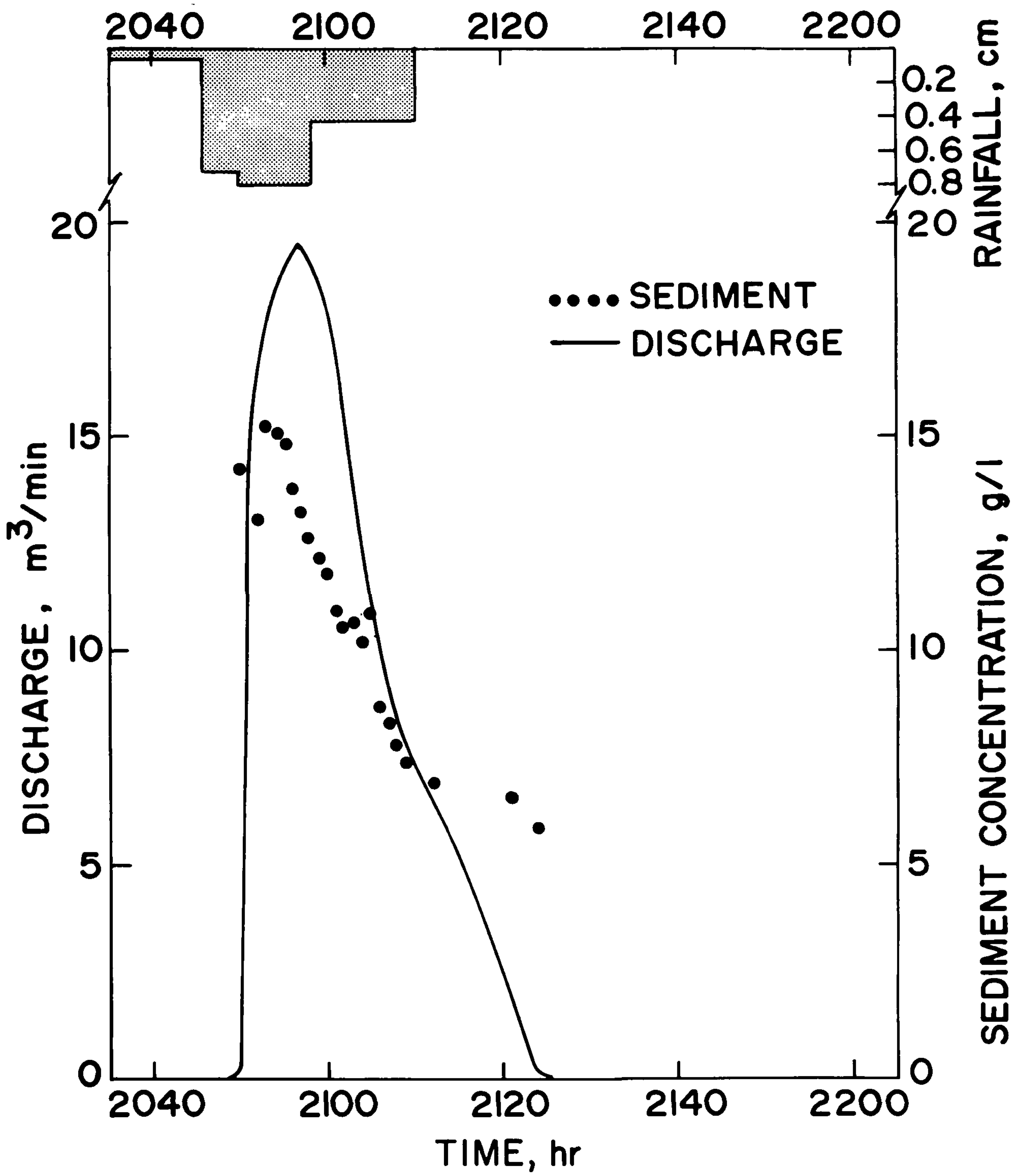


Figure 43. Rainfall, runoff, and sediment concentrations in runoff, watershed P1, 10 August 1972.

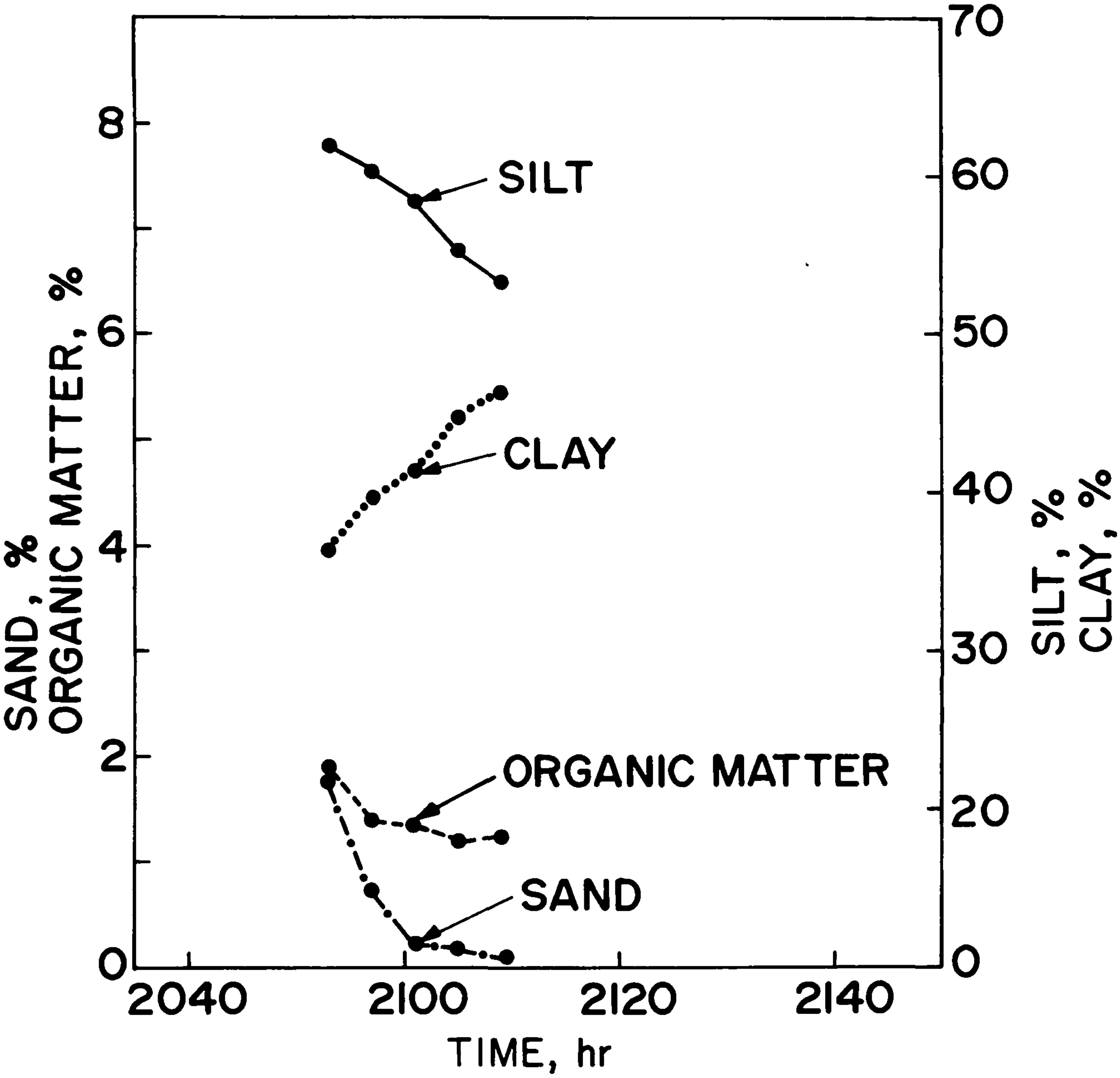


Figure 44. Sediment composition, watershed P1, 10 August 1972.

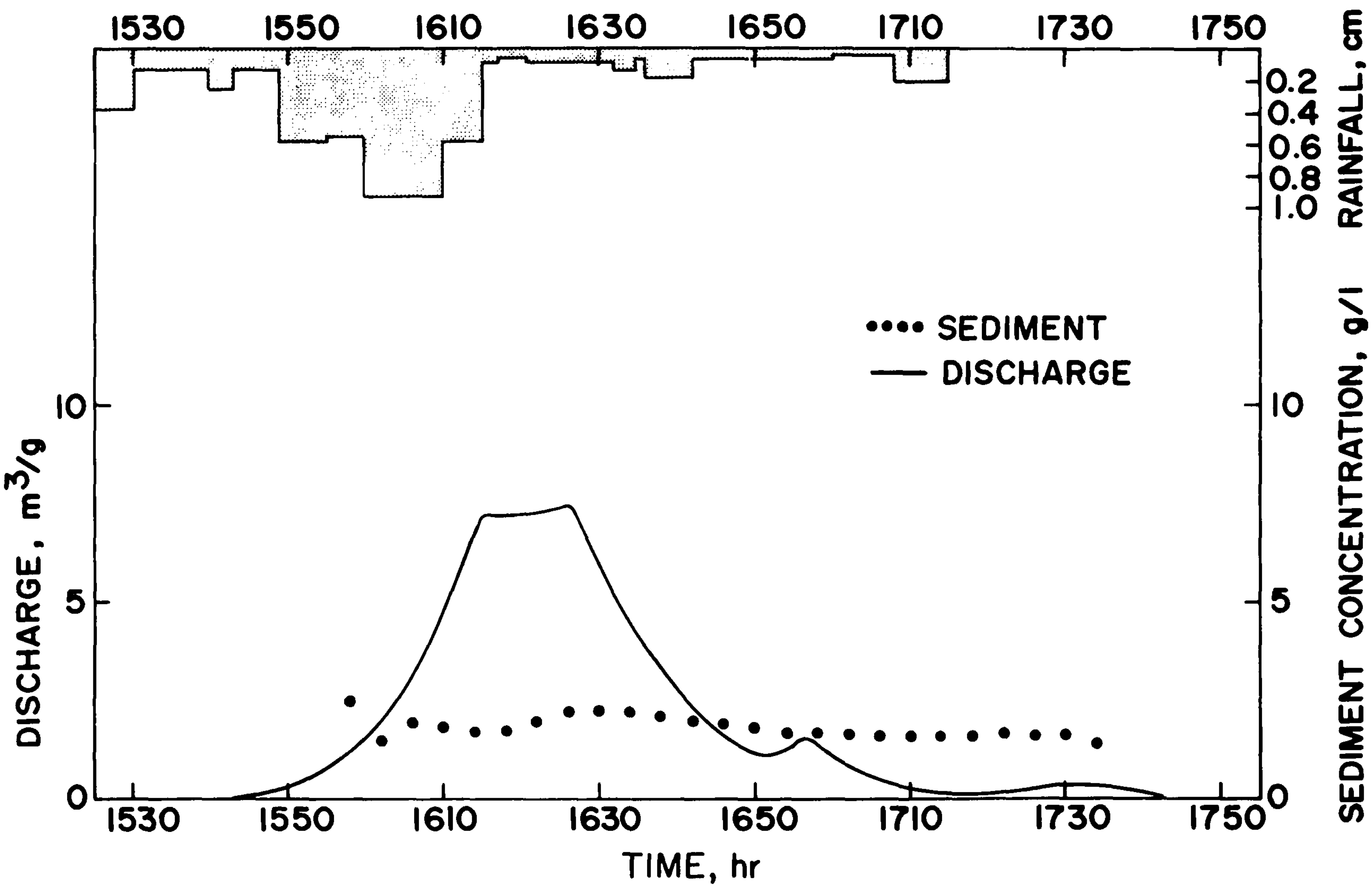


Figure 45. Rainfall, runoff, and sediment concentrations in runoff, watershed P3, 4 September 1972.

movement of NO_3 and Cl is related to this variability. A detailed analysis and discussion is beyond the scope of this report, however.

SEDIMENT YIELD AND PROPERTIES

Sediment yield is summarized in Table 14 by quarter for each year of the study. Cumulative sediment yield is also given in Figures 39 through 42. Typical sediment concentration distribution are shown in Figures 43 and 45 for watersheds P1 and P3, respectively. On all watersheds, more sediment was produced in spring and summer months when rainstorms were more intense and runoff greater. These results are consistent with past studies.[37,38] An additional factor contributing to high sediment yield during these periods was the state of the watershed surface. During and shortly after tillage operations, the soil was loose and very susceptible to erosion. In 1973, a series of storms occurred when all watersheds had been recently tilled. About 10 cm of rain fell in less than 24 hours on 28 May in two separate high-intensity storms. On all watersheds, but especially on P1 and P2, the sediment produced in these storms dominated losses over the entire study period (Table 14, Figures 39 through 42).

Although no direct comparison between watersheds is possible because of different rainfalls and covers, the ranking for potential sediment production between watersheds obviously was: P1>P2>P3>P4. Watershed P1, with its long slope, unbroken by conservation structures produced the most sediment, as expected. Conservation measures present on P3 and P4 apparently reduced sediment yield.

Adoption of no-till practices and installation of a grassed waterway on P1 in the fall of 1974 drastically reduced soil loss. From limited observations in 1975, this practice appeared to provide nearly complete protection from soil erosion (Table 14).

Soil erosion is a selective process with preferential removal of the fine-grained fractions. These fractions have the greatest capacity for transporting adsorbed chemicals. Organic matter in sediment has a high affinity for adsorbing pesticides and also contributes to the net transport capacity of the sediment. Therefore, apriori knowledge of sediment transport capacity as well as sediment yield is desirable in development of mathematical models predicting agricultural chemical runoff. Measurements were made for particle size distribution in the sediment samples from selected storms during 1972 and 1973. Because most of this phase of the study was confined to watersheds P1 and P3, only data from these watershed will be presented. The limited results from P2 and P4 show the same trends in enrichment of silt, clay, and specific surface.

Figures 43 and 45 show results from typical rainstorms occurring during the growing season of 1972 on watersheds P1 and P3, respectively. On watershed P1, sediment concentrations in runoff tended to be higher initially during the runoff period, the concentration maximum coinciding with the maximum in runoff (Figure 44). The percentage of sand, silt and organic matter tended to decrease with time after initiation of runoff; whereas, clay

TABLE 14. QUARTERLY SEDIMENT YIELDS FROM WATERSHEDS, mt/ha

Watershed	Year	Jan, Feb, Mar	Apr, May, Jun	Jul, Aug, Sep	Oct, Nov, Dec
P1	1972			3.6	1.7
	1973	4.4	38.0	3.2	0.8
	1974	0.1	7.9	4.5	0.003
	1975	0.2	0.04	0.002	
P2	1973		10.8	0.5	0.05
	1974	0.002	1.1	0.8	0.
	1975	0.08	4.5	1.0	
P3	1972			2.0	0.3
	1973	1.0	4.3	1.5	0.1
	1974	0.003	0.8	0.8	0.005
	1975	0.01			
P4	1973		3.2	0.8	0.1
	1974	0.01	0.6	0.1	0.01
	1975	0.7	0.7	0.06	

content increased. Sediment concentration and composition in runoff from P3 was more constant throughout the runoff events (Figure 46). These differences between P1 and P3 can be ascribed to differences in land form and management. Rill erosion on P3 was less severe than on P1. The presence of terrace channels and the grassed waterway on P3 probably attenuated the sediment concentration peaks in relation to peak discharge through sedimentation of the coarser materials in the terrace channels and by filtration in the waterway. On P1, scour and deposition occurred throughout the natural drainage channels, especially immediately above the measuring flume. The decrease in sand and silt with an increase in clay content observed during an event (Figure 44) may have been caused by deposition of the coarser fractions as runoff velocities decreased near the measuring flume.

The relatively small quantities of sand transported through the flumes on both P1 and P3 is related to the size distribution of the sand fraction of the watershed soils as well as to the flow hydraulics. Table 15 shows the composition of the watershed soils and the distribution of size classes within the sand fraction. Most of the sand in these soils is coarse or medium in texture with very small quantities of very fine sand. Coarse sand fractions apparently were deposited prior to reaching the flume.

Table 16 summarizes findings over the study period on sediment composition in relation to composition of the watershed soils. Individual storm analyses were composited by month, weighing individual analyses in proportion to sediment yield to reflect an average sediment composition by month. The values in Table 15 for the watershed soils were used to compute the enrichment/depletion ratios in Table 16. As reflected in the monthly summary, clay and silt enrichment ranged from 2 to 4 for most runoff events. Specific surface and organic matter enrichment was also in this same range. Exceptions were periods in early spring (February to April) on P1. During this period, some of the sand that had been previously deposited in the watershed above the flume was eroded and transported in runoff. This is best illustrated in Figure 47, which shows average specific surface of the transported sediment over the study period. The low point in specific surface was in April 1973 when particle size analysis showed sand to be highest.

These limited data do not allow prediction of sediment transport capacity for each runoff event of the study; however, for the growing season when pesticide runoff was highest, the sediment adsorption capacity appeared to average two to three times that of the residual watershed soils.

PESTICIDE PERSISTENCE AND VERTICAL MOVEMENT IN SOILS

The actual physical state of a pesticide molecule in the soil may be (1) crystalline, (2) dissolved in pore water, (3) adsorbed on a soil colloid (inorganic or organic), (4) chemically complexed with a soil constituent, or (5) retained in some inert carrier, shielded from the soil. Not only is the physical form varied, but the distribution of chemical in the soil may be quite heterogeneous. Pesticide concentrations in soil may be attenuated by many different processes such as biological degradation and transformation, chemical and photochemical degradation, volatilization, and redistribution in

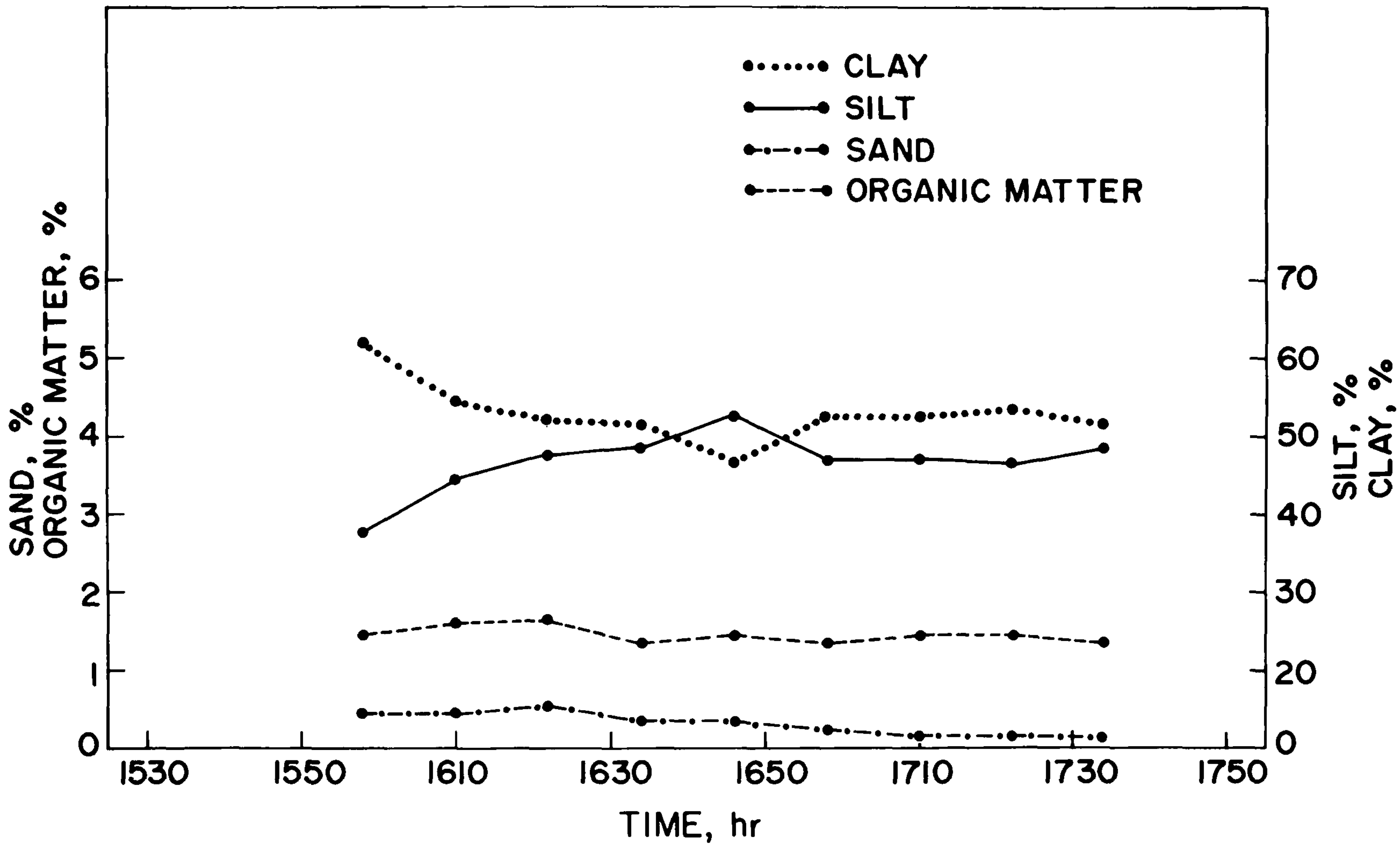


Figure 46. Sediment composition, watershed P3, 4 September 1972.

TABLE 15. AVERAGE COMPOSITION OF P1 AND P3 WATERSHED SOILS

Watershed	Total sand	CS >0.5 mm	MS 0.5-0.25 mm	FS 0.25-0.10 mm	VFS 0.10-0.05 mm
	%				
P1	67.7 ± 3.7*	32.6 ± 8.2	16.8 ± 1.1	14.9 ± 3.7	4.2 ± 1.1
P3	63.7 ± 3.0	32.7 ± 3.2	13.0 ± 0.3	13.8 ± 1.5	4.5 ± 0.9

Watershed	Silt	Clay	Organic matter	Specific surface
	%			- m^2/g --
P1	20.7 ± 2.2	11.6 ± 2.0	0.6 ± 0.1	5.8 ± 1.3
P3	19.8 ± 3.0	16.5 ± 2.0	0.6 ± 0.1	9.0 ± 1.1

*Average of all sampling areas within watershed, ± standard deviation.

TABLE 16. DIFFERENCE BETWEEN SEDIMENT COMPOSITION AND COMPOSITION OF IN SITU WATERSHED SOILS*

Date	Sand	Silt	Clay	Organic matter	Specific surface
Watershed P1					
Jul 1972	0.02	2.62	3.86	2.94	2.53
Aug 1972	0.01	2.83	3.53	2.95	2.53
Dec 1972			-	3.19	3.54
Feb 1973	0.30	2.24	2.91		2.59
Mar 1973	0.69	1.55	1.82	-	1.30
Apr 1973	1.06	0.58	1.42		0.85
May 1973	0.01	2.73	3.69	-	2.69
Jun 1973	0.03	2.59	3.81	2.81	2.20
Jul 1973	0.06	2.77	3.32	2.42	2.91
Aug 1973	0.03	2.39	4.19	-	3.06
Sep 1973	0.18	2.60	2.96	2.01	2.24
Dec 1973	0.15	2.33	3.63	2.12	2.05
Feb 1974	0.19	2.47	3.10	-	1.91
Apr 1974	0.23	2.77	2.36	-	1.95
Watershed P3					
Jul 1972	0.020	2.03	3.54	2.75	1.96
Aug 1972	0.004	2.12	3.50	2.83	2.19
Sep 1972	0.010	2.40	3.15	2.59	1.95
Dec 1972	-	-	-	2.48	2.43
Feb 1973	-	-	-		2.28
Mar 1973	-	-	-	-	2.23
May 1973	0.001	1.92	3.76	-	2.46
Jun 1973	0.010	1.48	4.27		2.08
Jul 1973	0.010	1.96	3.69	2.45	2.64
Sep 1973	-		-	2.79	1.86
Dec 1973	-			2.96	

*Ratio of sediment composition to soil composition.

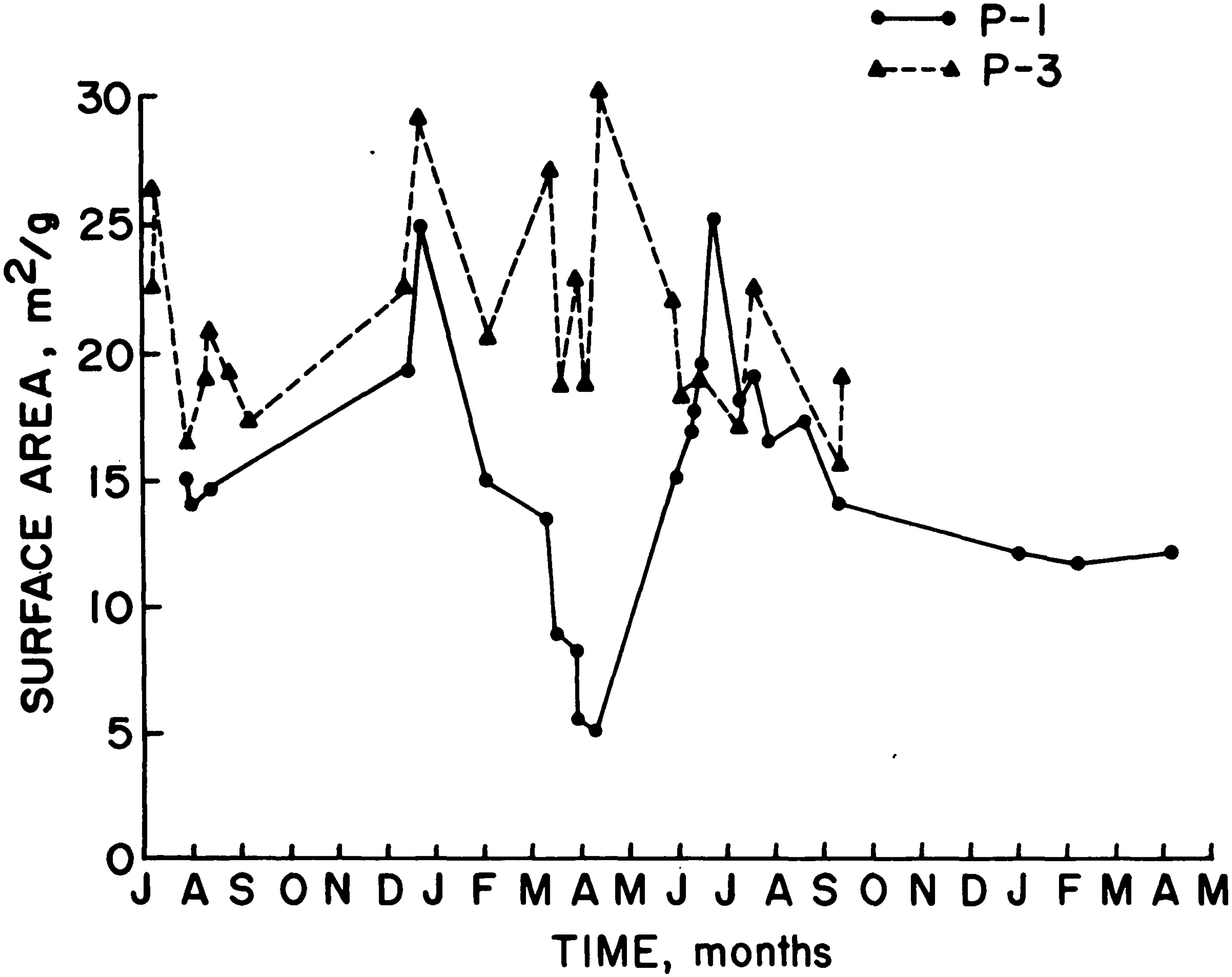


Figure 47. Sediment specific surface area relationship with time over study period.

response to rainfall and infiltration. Therefore, determination of pesticide residue remaining is soil with time at the watershed scale is a difficult task where sufficient accuracy and precision in the data is desired to allow mathematical expression of the attenuation rate. One of the first requirements is to determine the amount of pesticide actually applied to the soil surface.

This study established that pesticide application to the soil surface can be monitored by one of three methods: (1) filter disc, (2) nozzle discharge (timing), and (3) surface soil sampler. As shown in Table 5, there was a close correspondence between the various monitoring methods.

Initial attempts in 1972 and 1973 at conventional monitoring pesticide application by soil sampling techniques failed to produce reliable data. Spatula sampling the top (0 to 1 cm), and small core samples were tried but both techniques were beset with similar problems when used to determine pesticide quantities in loose soils. In 1972 and 1973, application rates were assumed to be the intended target rate. Application rates for all years and watersheds are given in Table 4.

Monitoring of pesticide residue throughout the cropping season required various techniques as shown in Figure 48. The "split tube" sampler provided the bulk of the soil core pesticide data; however, this method has serious limitation when sampling loose soils on planting day and prior to rainfall events. These problems include: (1) core compression during sampling, (2) lack of depth zone definition, and (3) inter-depth zone contamination. Also, bulk density is not well defined in loose soils, which further jeopardizes use of the sample for mass computations. This method, however, has proven to be very reliable for post-rainfall pesticide sampling for both mass balance and pesticide distribution purposes. Pesticide residues found in samples removed as described above at different times after application are given in Tables G1 through G30.

Pesticides at or near the soil surface contribute heavily to runoff. Table 17 gives estimated $t_{1/2}$ (time required for a 50 percent reduction in pesticide quantity) in the top cm of the soil profile. These times were estimated by fitting pesticide residue determination F(t) to the equation:

$$F(t) = C_1 e^{-Kt} + C_2 \qquad (1)$$

where C_1, K and C_2 are fitted constants.

$$t_{1/2} = \frac{1}{K} \ln\frac{2C_1}{C_1 - C_2} \qquad (2)$$

C_2 is a slowly decaying pesticide residue that can be assumed to be constant over the crop growing season.

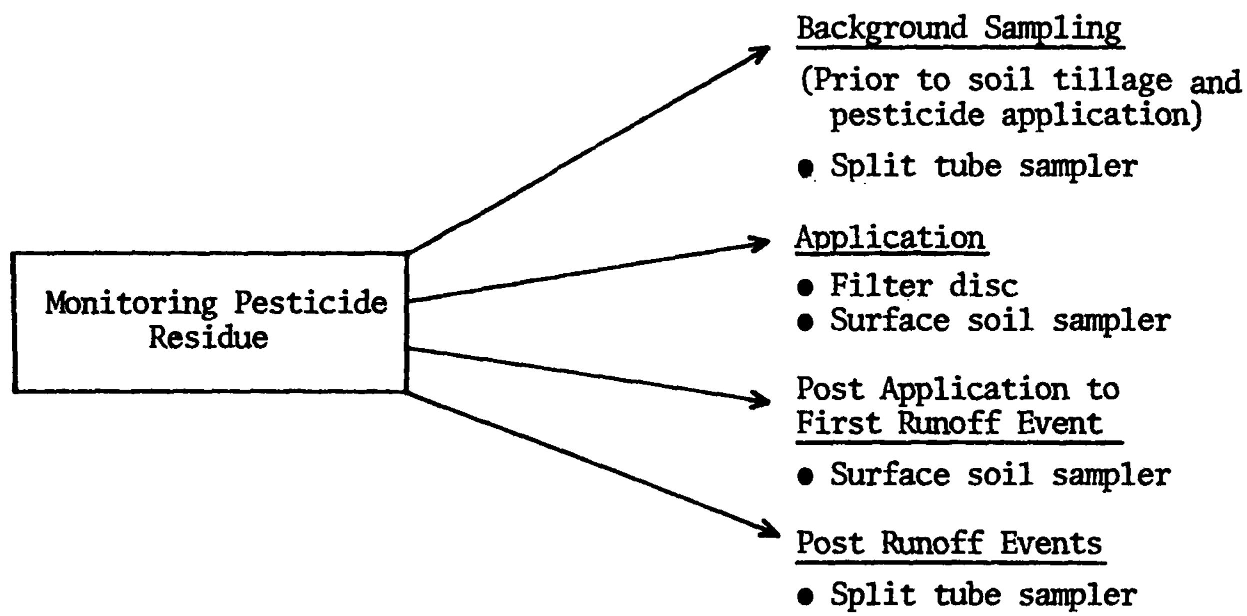


Figure 48. Summary of various sampling techniques used throughout the cropping season.

TABLE 17. HALF-LIFE ($t_{1/2}$)* PERSISTENCE OF TEST COMPOUNDS FOR DIFFERENT CROPPING YEARS IN THE SURFACE SOIL, 0-1 cm

Compound	1973				1974				1975			
	P1	P2	P3	P4	P1	P2	P3	P4	P1	P2	P3	P4
Diphenamid	1.3		4.9		3.6		4.0					
Trifluralin	2.6		14.7									
Atrazine		2.4		2.5		4.0		3.4		3.2†		4.2
Cyanazine										4.4†		2.9
Paraquat		11.3		6.8	34.6	14.6	24.7					
Propazine									7.5			

*$t_{1/2}$ = Time required for a 50 percent reduction of pesticide quantity.

†Values obtained by surface soil sampler at a depth of 0 to 2.5 centimeters.

With the exception of paraquat, the $t_{½}$ tends to be less than 1 week for all compounds. This reaffirms the previous observation concerning the significance of the early post-application runoff events. These $t_{½}$ combine the effects of runoff, degradation, vertical movement, and volatilization and tend to very widely from year to year due primarily to changes in rainfall patterns.

Plots of pesticide mass remaining in the soil throughout the growing season showed that for atrazine, diphenamid, and propazine, a sharp break in disappearance rate effected by rainfall, Figures 49, 50, and 51. Paraquat and cyanazine showed little or no change in disappearance rate, Figures 52 and 53. A general way to treat these data is to fit pre- and post-rainfall behavior to separate first-order rate equations.

In 1975, watersheds P2 and P4 were sampled daily from planting to rainfall using the surface soil sampler described previously. Two additional sets of samples were collected after the first rainfall on P2, Table 18. The samples were taken to a depth sufficient to get all the applied pesticide; this was approximately 2.5 cm prior to rainfall and 7.5 cm post-rainfall.

The disappearance rate constant for atrazine, Figure 54, was reduced by a factor of five because of rainfall. Data from previous growing seasons indicated the same behaviorial patterns in atrazine disappearance; however, cyanazine shows no change in the disappearance rate over the sampling period, Figure 53.

In the field study, the pesticides (except trifluralin) were surface applied on loosely tilled soil. Under this type of application, spray-target soil particles are heavily loaded with pesticide. Dispersion from target particles is mediated primarily by water flux, which is generally low under application conditions. Also, surface soils in a loosely tilled condition can get very hot compared with air temperature. Tillage breaks the thermal and hydraulic "contact" with the subsurface soil layers and, thus, enables the existence of sizable temperature gradients near the surface, both relative to subsurface soil temperature and air temperature. Table 18 gives average surface soil temperatures taken on P2 (1975) sometime between 1000 and 1400 hours each day; the air temperature during this peiod was generally about 25 °C. The surface soil temperature was 15 °C hotter than the prevailing air temperature during the planting day. This gradient gradually decreased over the 7-day rainless period. After a light rain had settled the surface soil somewhat, the surface soil temperature decreased markedly as did the heretofore mentioned gradient.

Rainfall disperses the applied pesticide from the target particles, thus effecting a drastic change in the microscopic concentration of pesticide within the soil. This dispersion from target particles may also change the attenuative modes available to the compound; downward movement may retard photochemical and volatilization attenuation, but enhance microbial degradation.

Typical patterns of herbicide distribution found with depth are shown in Figures 55 and 56. Atrazine (Figure 55) would be expected to be somewhat

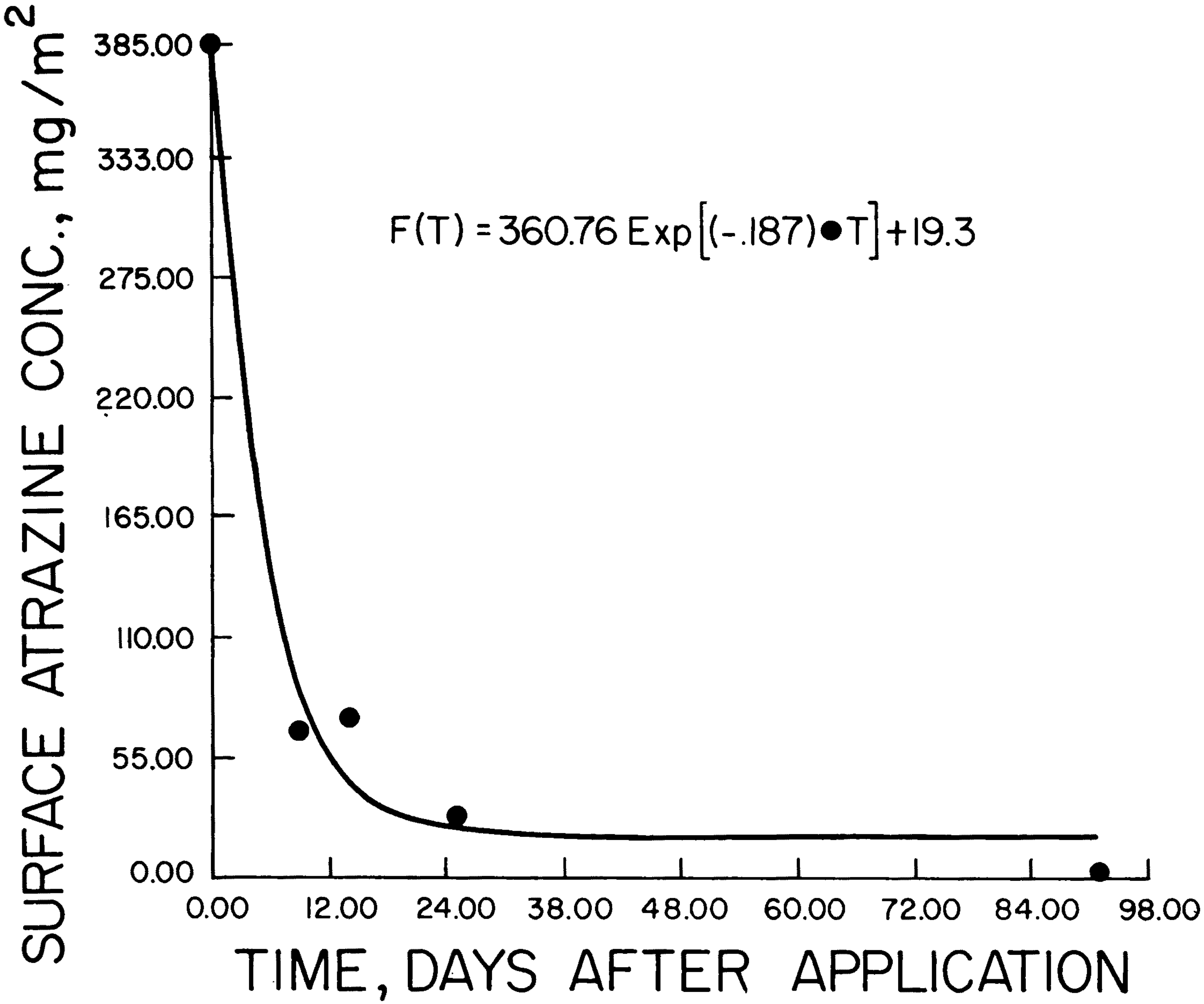


Figure 49. Atrazine persistence in top centimeter of soil, watershed P2, 1974.

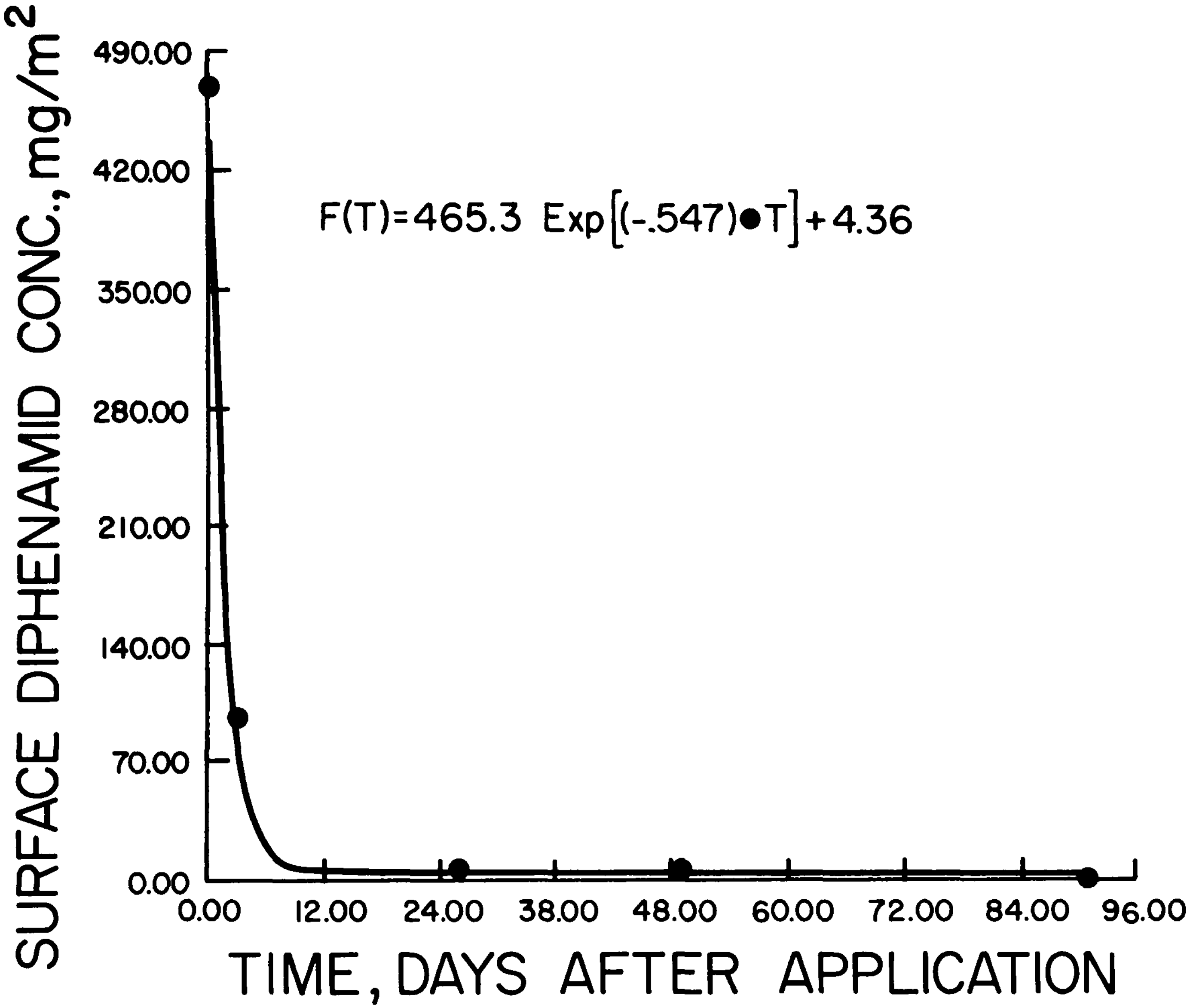


Figure 50. Diphenamid persistence in top centimeter of soil, watershed P1, 1973.

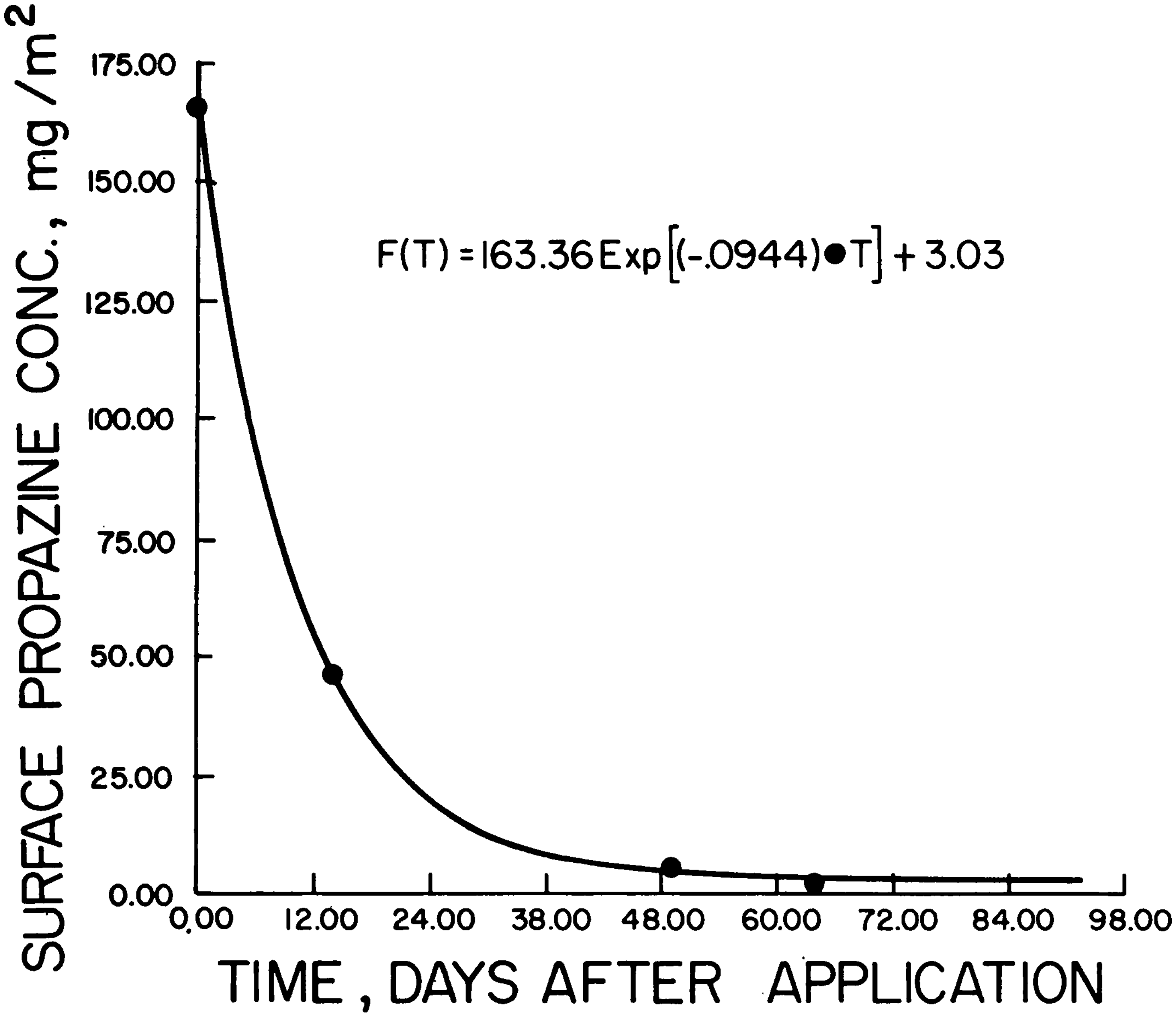


Figure 51. Propazine persistence in top centimeter of soil, watershed P1, 1975.

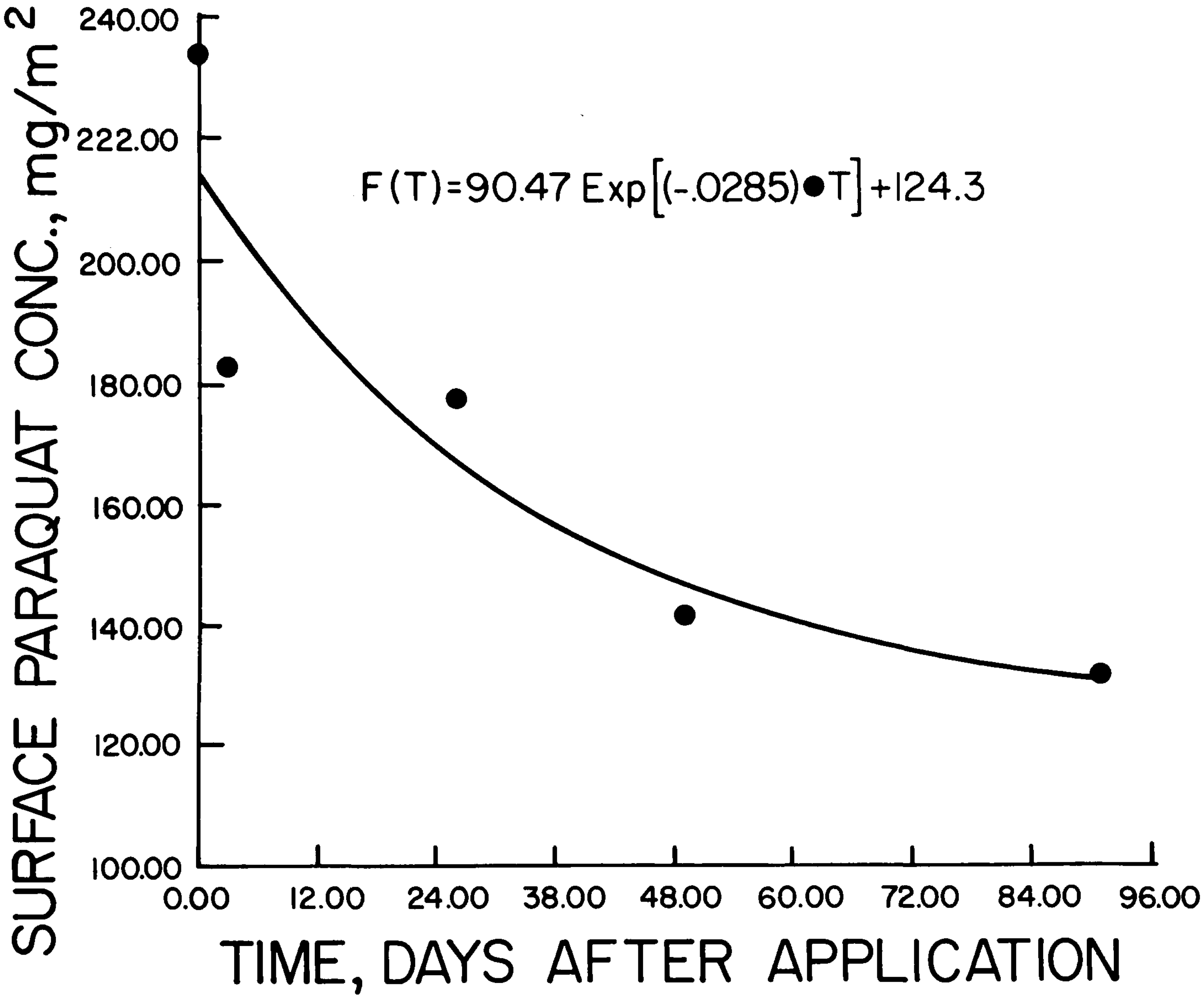


Figure 52. Paraquat persistence in top centimeter of soil, watershed P1, 1973.

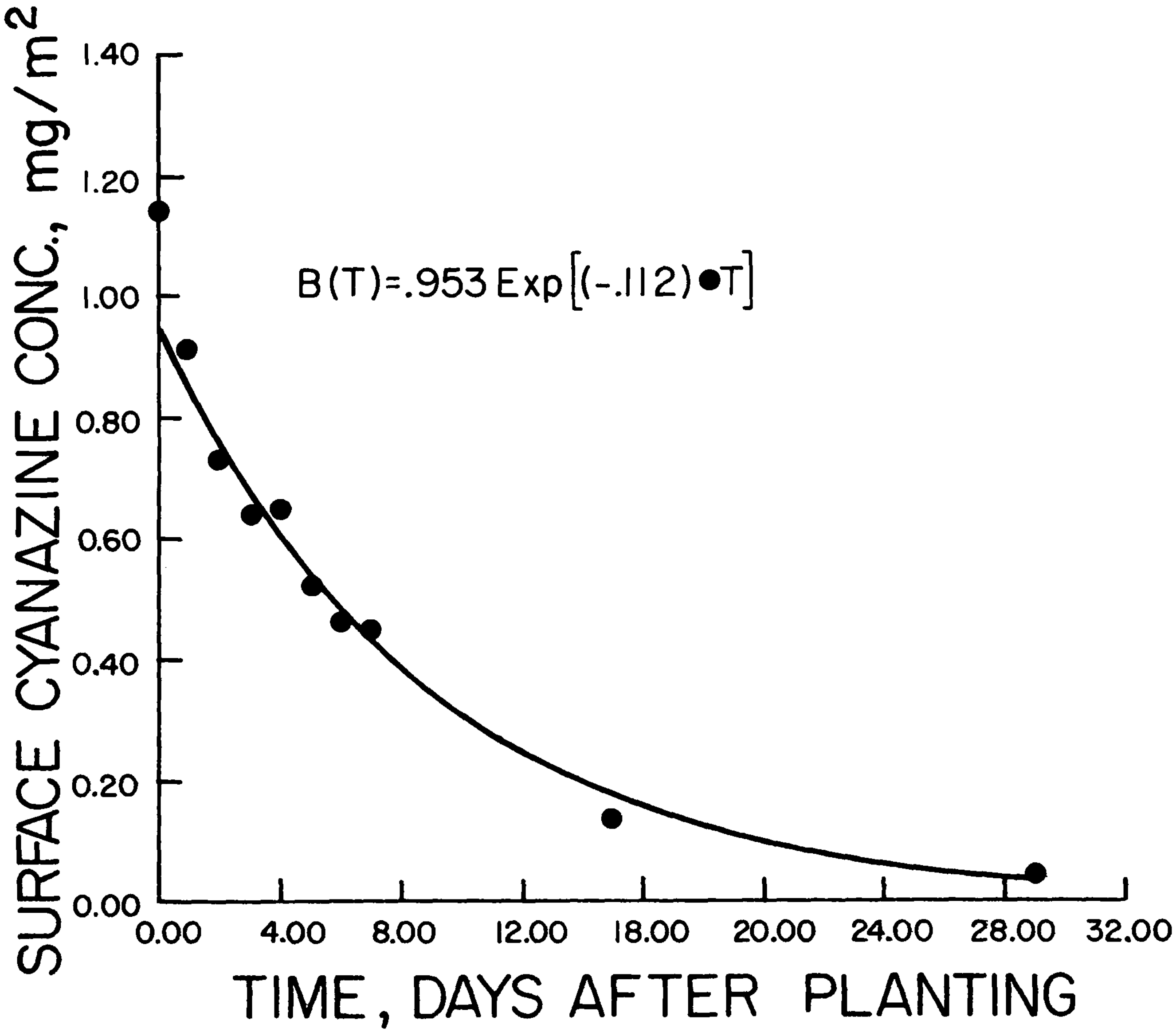


Figure 53. Cyanazine persistence in top 2.5 centimeters of soil, watershed P2, 1975.

TABLE 18. HERBICIDE RESIDUE FROM TIME OF APPLICATION TO FIRST RUNOFF EVENT, WATERSHED P2, 1975

Days after planting	Soil temperature, °C	Soil moisture, %*	Total herbicide, kg/ha		
			Atrazine	Cyanazine	Paraquat
0	45.2	7.0	1.278 (0.192)†	1.139 (0.139)	1.990 (0.314)
1	30.4	5.4	0.873 (0.262)	0.914 (0.222)	1.970 (0.279)
2	33.1	2.9	0.641 (0.233)	0.729 (0.171)	1.836 (0.447)
3	49.0	1.8	0.537 (0.214)	0.641 (0.223)	1.746 (0.351)
4	38.2	1.9	0.518 (0.267)	0.649 (0.320)	1.827 (0.409)
5	29.2	2.6	0.398 (0.177)	0.518 (0.098)	1.789 (0.279)
6	29.2	1.4	0.302 (0.134)	0.458 (0.138)	1.728 (0.356)
7	18.7	3.6	0.318 (0.145)	0.453 (0.153)	1.740 (0.324)

*Determined gravimetrically.

†Standard deviation.

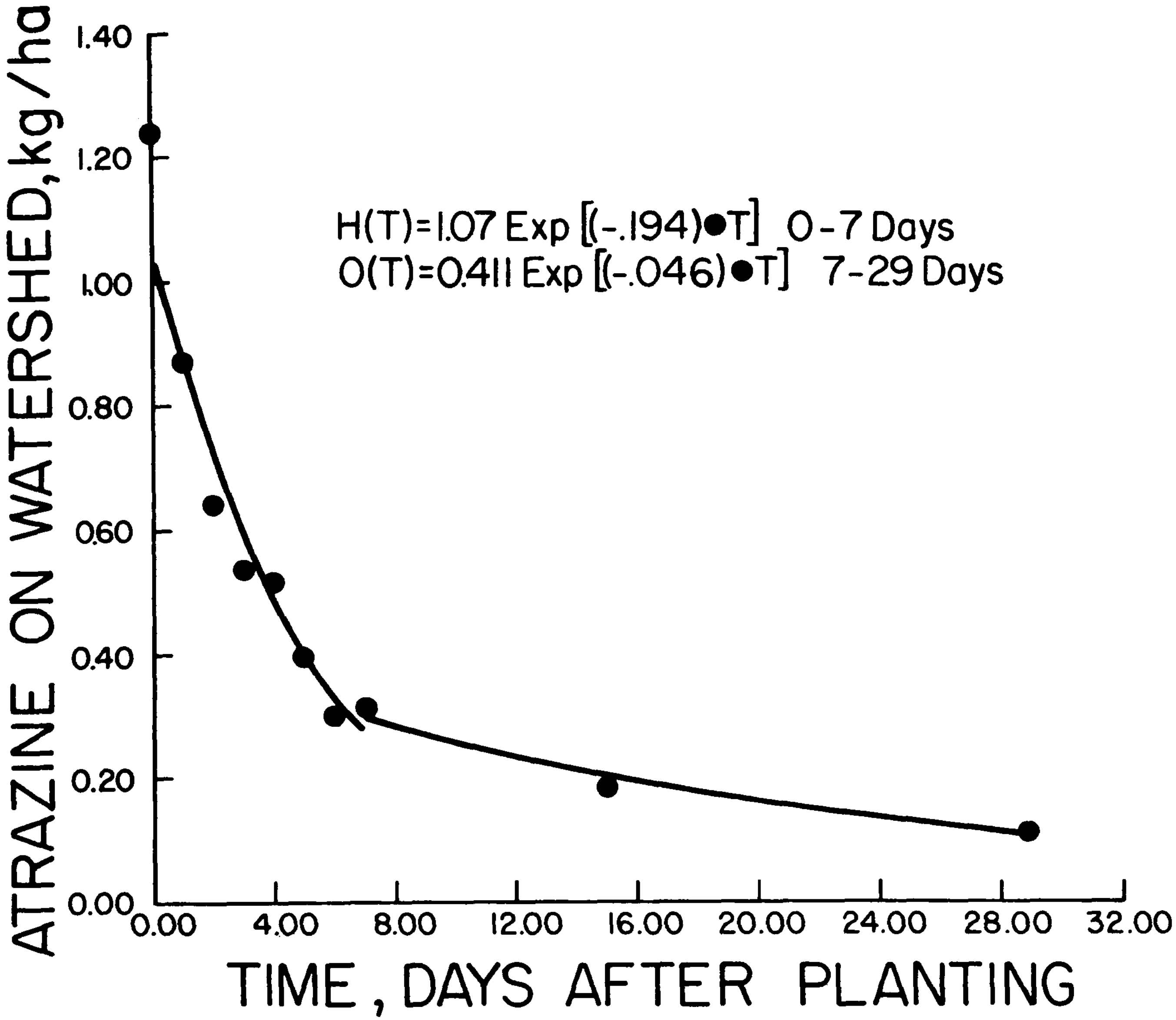


Figure 54. Atrazine persistence in top 2.5 centimeters of soil, watershed P2, 1975.

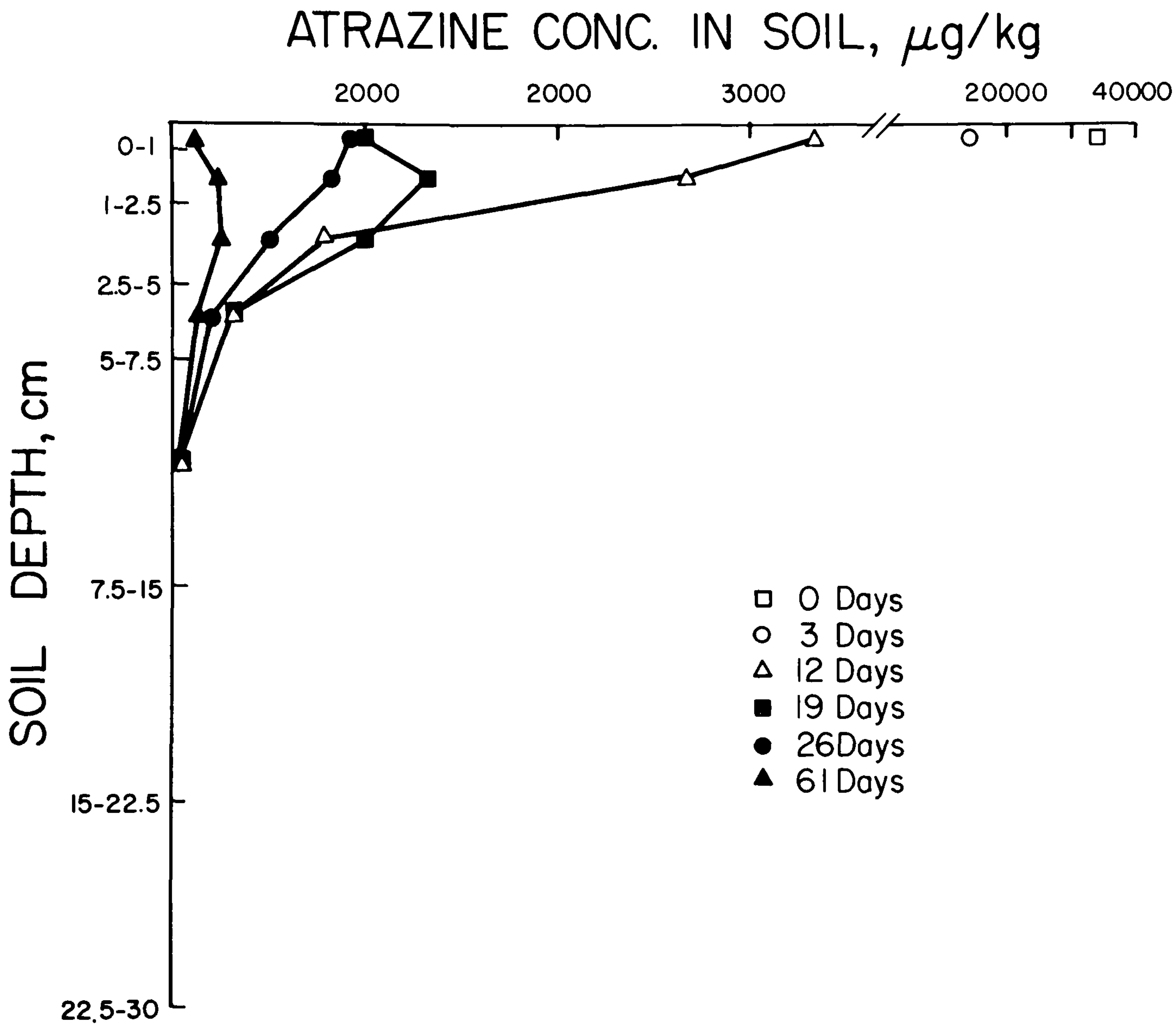


Figure 55. Atrazine concentration in soil profile over sampling period, watershed P2, 1973.

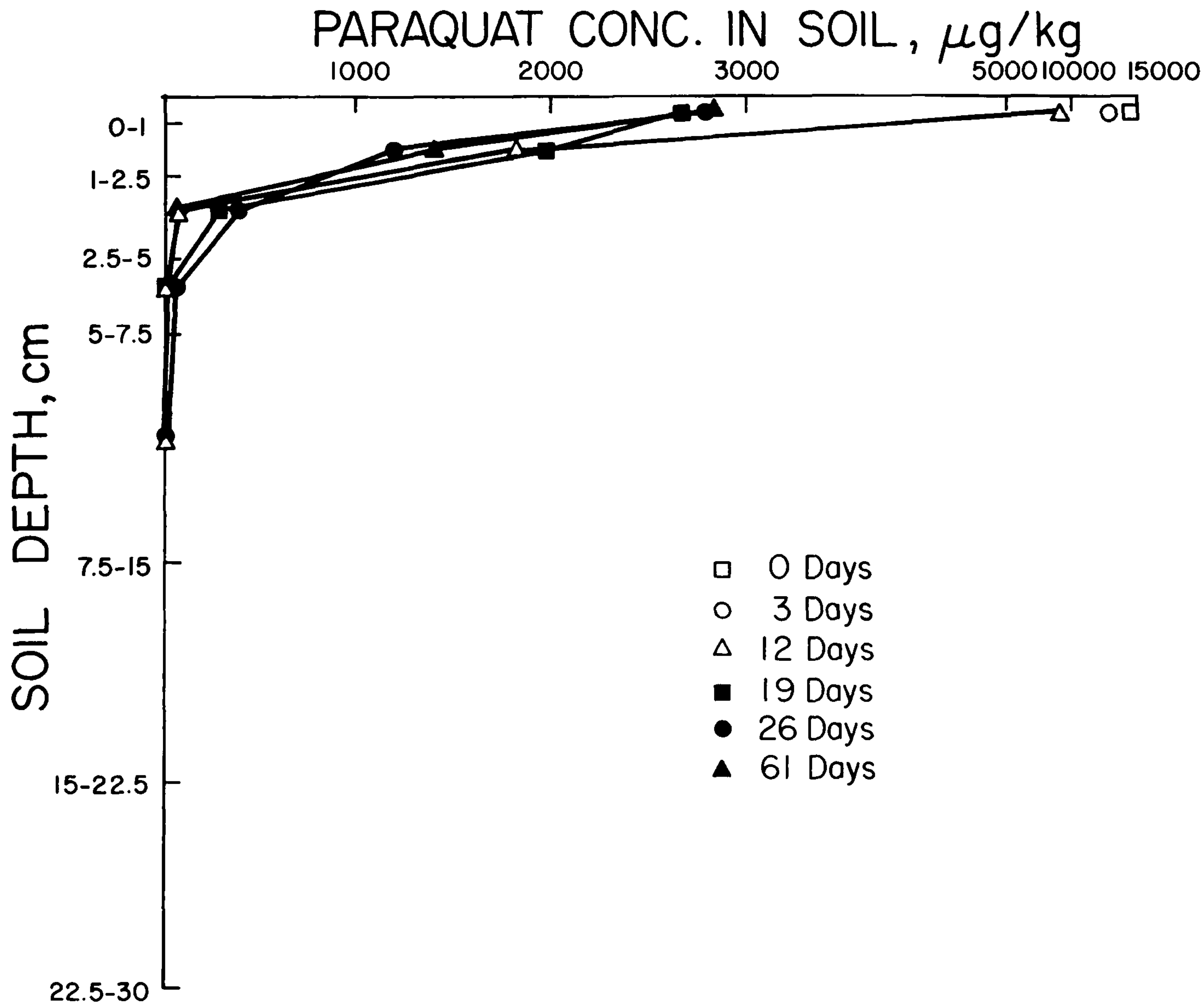


Figure 56. Paraquat concentration in soil profile over sampling period, watershed P2, 1973.

susceptible to leaching and redistribution in response to rainfall, whereas paraquat (Figure 56) would be essentially immobile. Paraquat and atrazine were applied together in the same spray. With time, paraquat showed little apparent redistribution below the soil surface. Some atrazine, however, apparently moved to depths of 5 to 7 cm with the first few rainfall events. Other processes of attenuation (degradation, possibly volatilization) are going on simultaneously, however, and these evidently proceed sufficiently rapid that little atrazine was detected below 15 cm.

In summary, all herbicides studied except paraquat were found to disappear rapidly from the surface (0 to 2.5 cm) soil zone. Some leaching to deeper zones was indicated, but the major processes involved in the disappearance of the compounds were evidently degradation and volatilization. As shown in Table 19, runoff losses accounted for a relatively small fraction of the applied herbicides. This is not to say that pesticide runoff is unimportant from an environmental standpoint. In view of the rapid attenuation of the applied herbicides in the runoff zone, the potential for partitioning to runoff, as shown in the following section was markedly influenced by the proximity of the first runoff producing rainstorms to application.

PESTICIDE RUNOFF

Plots of selected storms to depict the nature of pesticide runoff within single storm events are shown in Figures 57 through 67. Only storms from watershed P1 and P2 are included so that each test pesticide is illustrated. Storm hydrographs and rainfall distribution and sediment graphs are also included to characterize the nature of the event. Except for Figure 67, all concentrations are plotted as step functions rather than smooth continuous curves. The concentrations plotted are values for individual samples that are a composite over discrete time intervals, with the length of sampling interval depending on discharge volume. The determined concentrations are, therefore, plotted as line segments, with the segment length reflecting the sampling interval. The line segments were then connected by vertical lines to produce the concentration plots. storms selected for illustration were those significant runoff events that occurred soon after chemical application.

Trifluralin, diphenamid, and paraquat in runoff is shown in Figures 58, 59, and 60, respectively, as a result of a thunderstorm occurring on P1 on 13 June 1973. Because this event occurred a few hours after application of chemicals on the day of planting, concentrations in runoff were relatively high. This storm was very local in nature with a small storm cell. From field observations made during the storm, it was questionable that the measured rainfall at the gauge reflected the amount of rainfall that actually fell on the upper portion of the watershed. Because of the proximity to planting, however, it was selected for discussion. The high sediment concentrations (Figure 57) during the storm is a result of the erosive nature of the storm and the freshly tilled, erodible state of the watershed.

Throughout the study, measured pesticide concentrations in runoff samples within a single storm were usually variable, fluctuating at times by as

TABLE 19. PESTICIDE RUNOFF SUMMARY

Pesticide type	Watershed	Year	Total amount applied, g	Amount in runoff, percent		Percent applied remaining in soil*
				Sediment	Water	
Atrazine	P2	1973	4,370	0.27	1.65	
		1974	4,950	0.02	0.17	3.04
		1975	2,000	0.12	0.58	
	P4	1973	4,640	0.04	0.79	
		1974	5,560	1.90	0.19	1.62
		1975	2,000	0.01	0.25	5.93
Cyanazine	P2	1975	2,090	0.13	0.87	
	P4	1975	1,860	0.01	0.07	0.00
Diphenamid	P1	1972	9,070	0.07	0.84	
		1973	9,070	0.14	7.05	1.20
		1974	9,500	0.02	0.25	10.42
	P3	1972	4,230	0.07	1.60	
		1973	4,230	0.03	0.57	1.09
		1974	3,980	0.01	0.11	0.06
		1975	2,910	0.01	0.24	0.00
Paraquat**	P1	1972	41,420	5.10	0	
		1973	4,130	22.06	0	
		1974	5,720	18.41	0	
		1975	4,480	0.91	0	
	P2	1973	1,990	10.88	0	
		1974	3,185	3.21	0	
		1975	2,510	9.43	0	
	P3	1972	19,330	3.37	0.03	
		1973	1,930	5.45	0	
		1974	2,440	3.00	0	
		1975	2,320	0.88	0	
	P4	1973	2,110	4.02	0	
		1974	2,660	0.93	0	
		1975	2,415	1.97	0	
Propazine	P1	1975	4,480	0.02	6.13	9.81
Trifluralin	P1	1972	3,020	0.01	0.11	
		1973	3,020	0.02	0.23	8.40
	P3	1972	1,410	0.02	0.17	
		1973	1,410	0.01	0.23	13.50
2,4-D	P2	1975	2,180	0.09	0.91	
	P4	1975	2,140	0.00	0.01	

*Data calculated from last sampling interval (60 to 91 days after planting).

**Runoff percentages after first year may reflect contributions from previous residue.

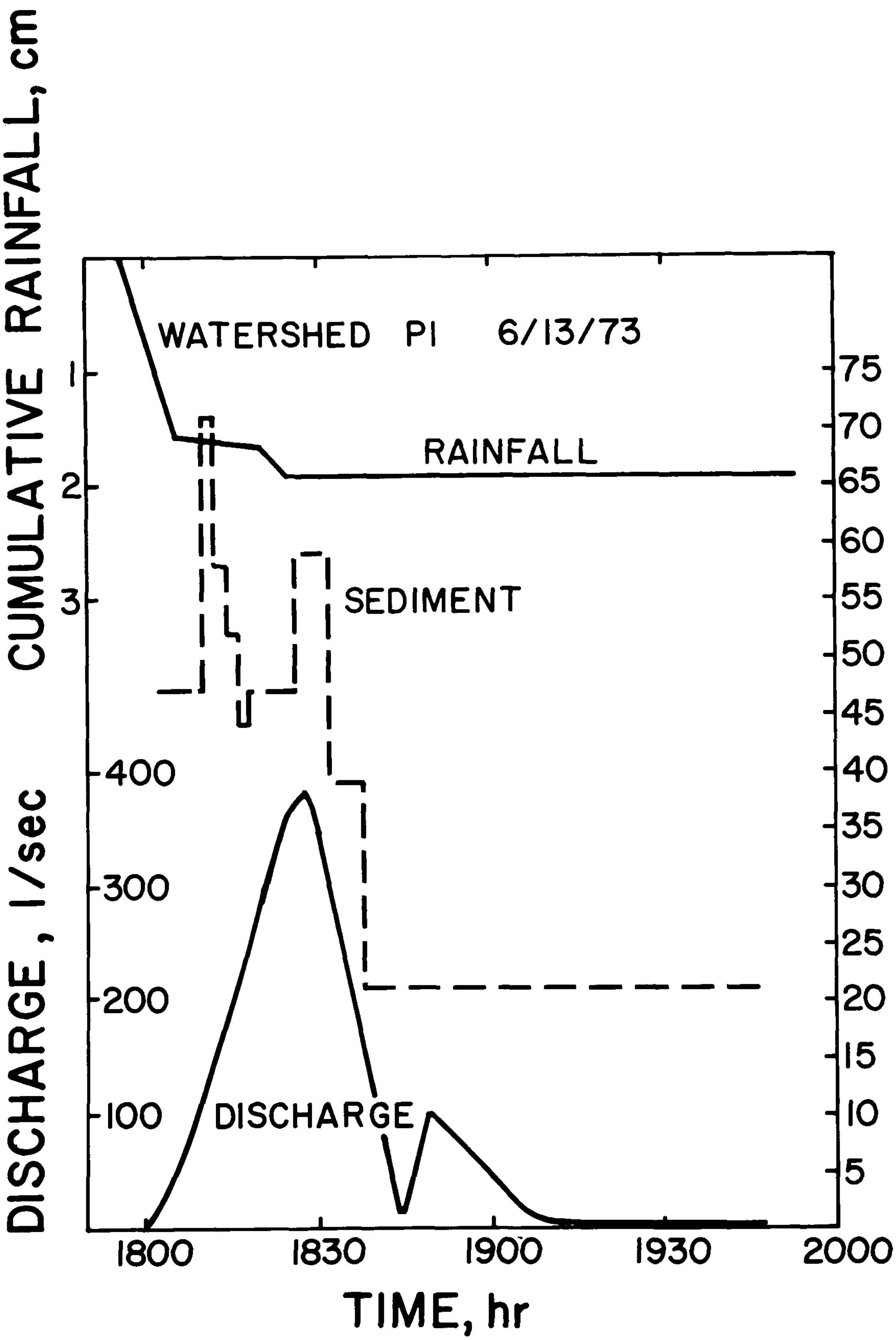


Figure 57. Rainfall, runoff, and sediment concentrations in runoff, watershed P1, 13 June 1973.

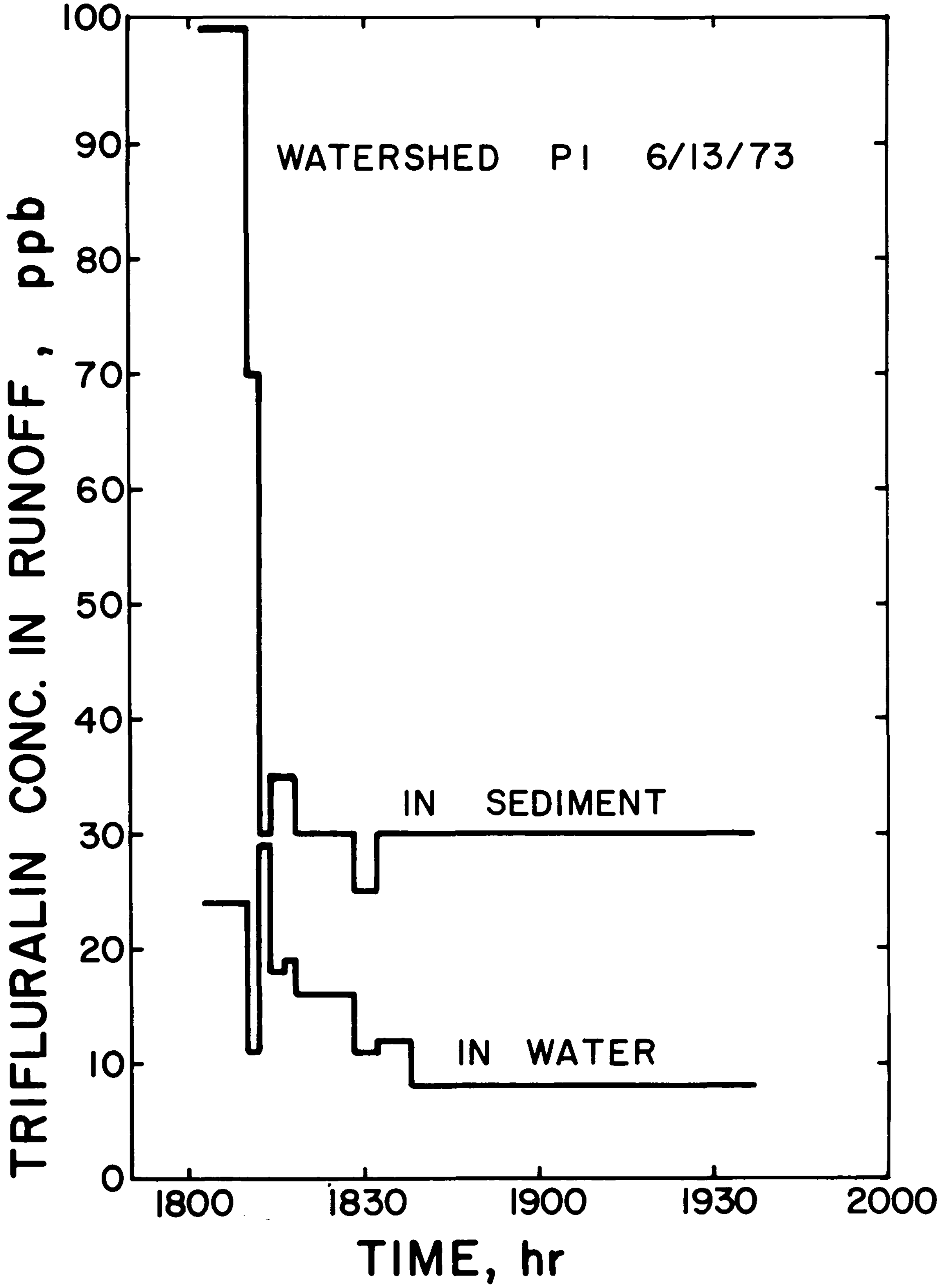


Figure 58. Trifluralin in water and sediment phases of runoff, watershed P1, 13 June 1973.

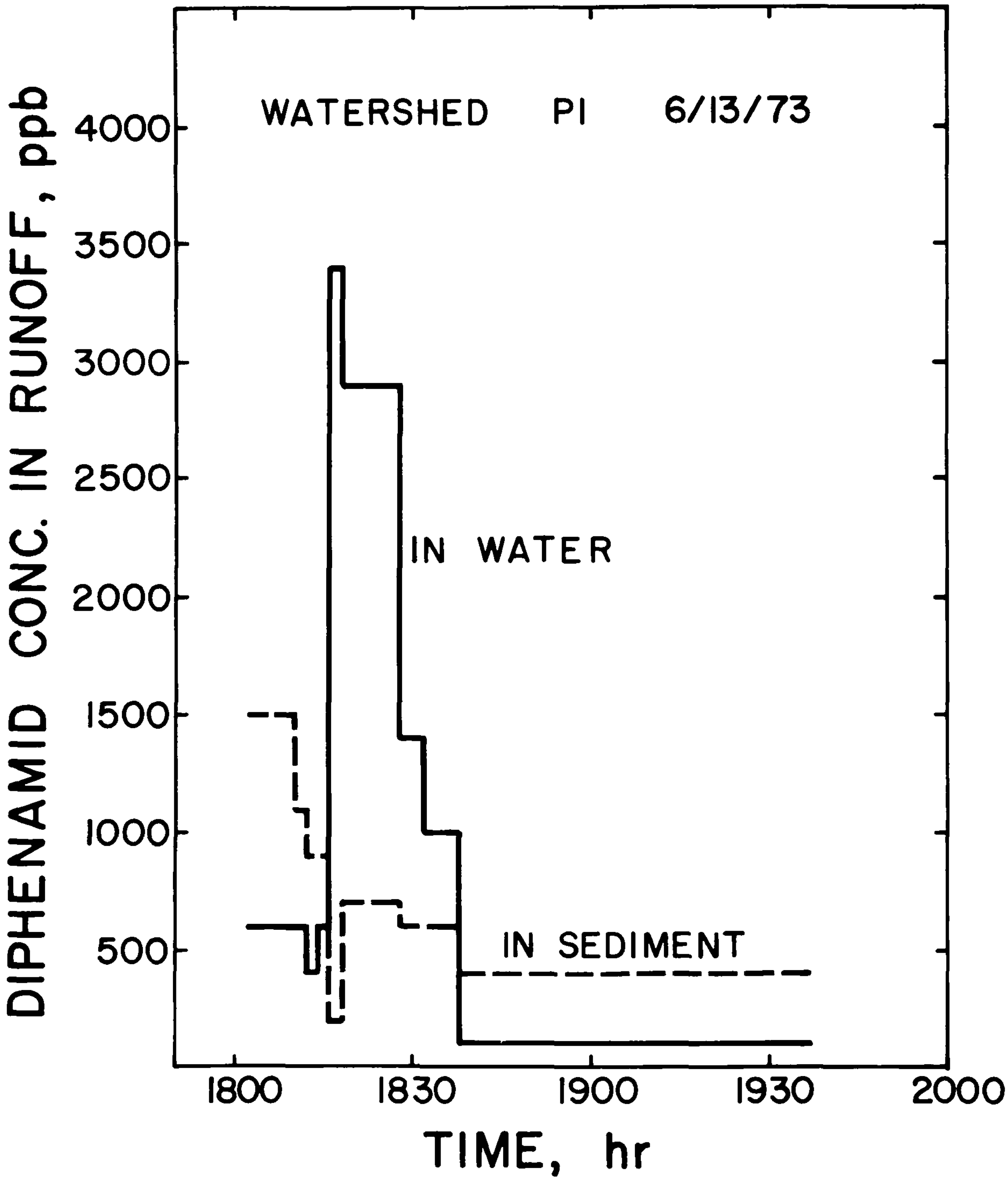


Figure 59. Diphenamid in water and sediment phases of runoff, watershed P1, 13 June 1973.

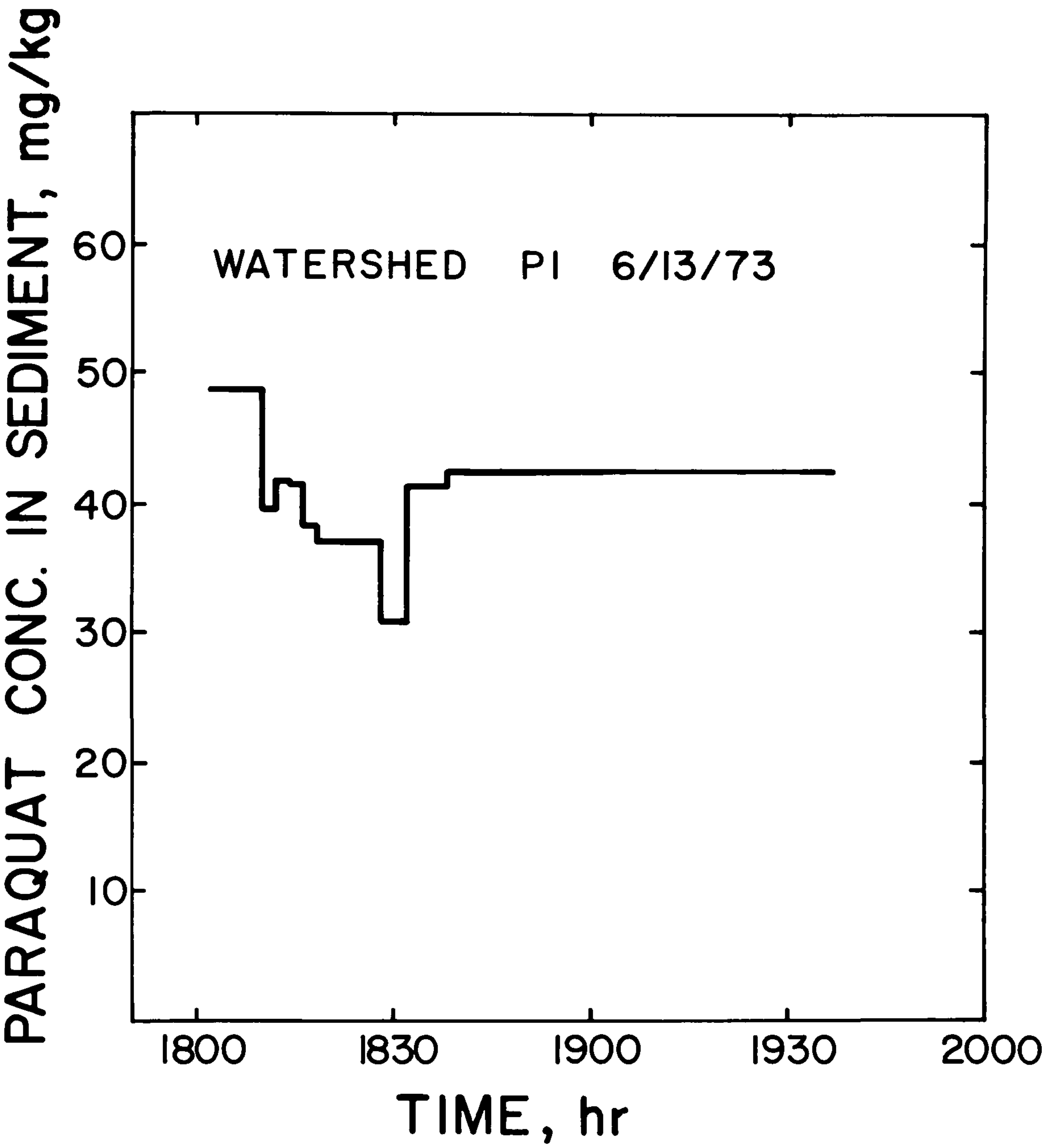


Figure 60. Paraquat in sediment, watershed P1, 13 June 1973.

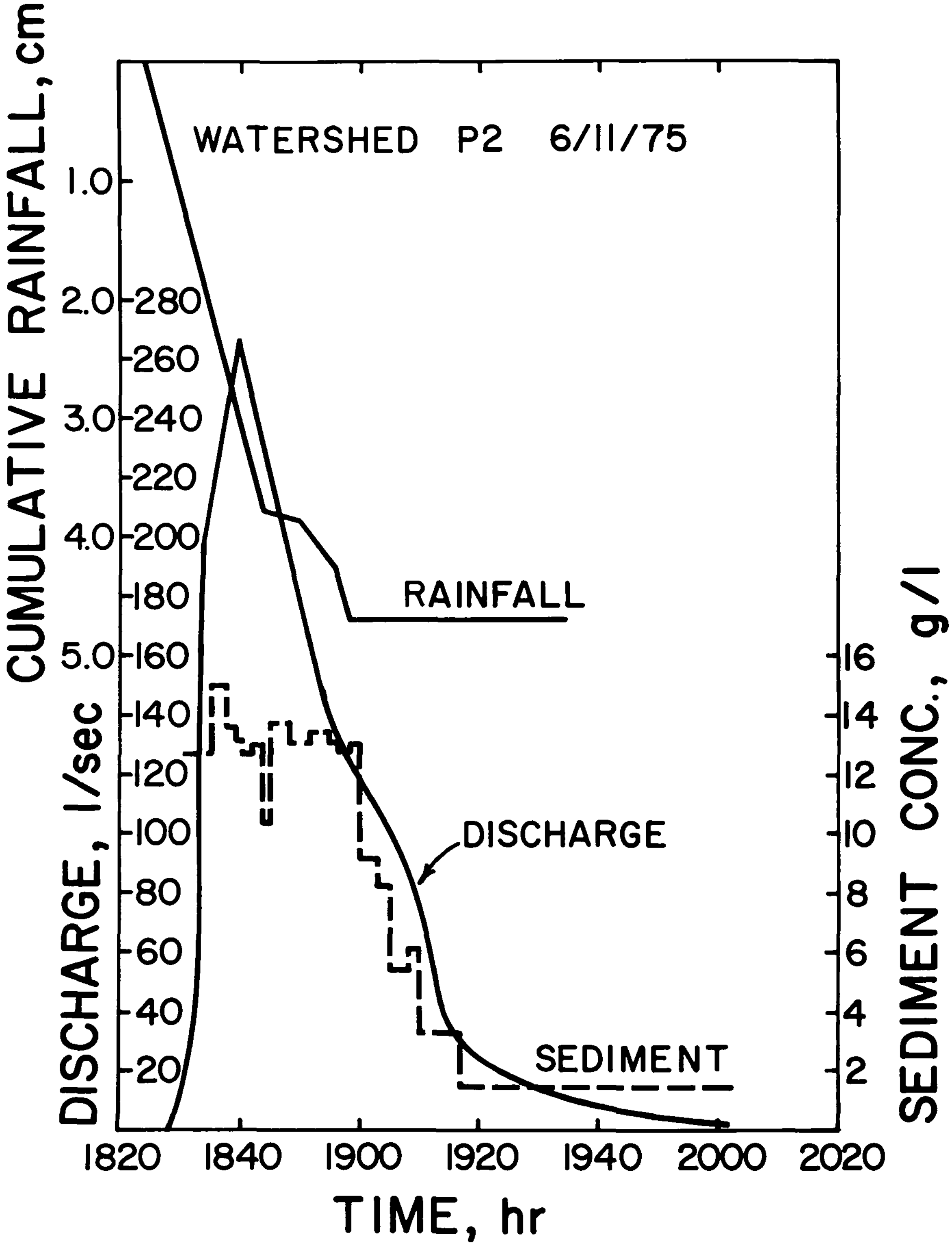


Figure 61. Rainfall, runoff, and sediment concentrations in runoff, watershed P2, 11 June 1975.

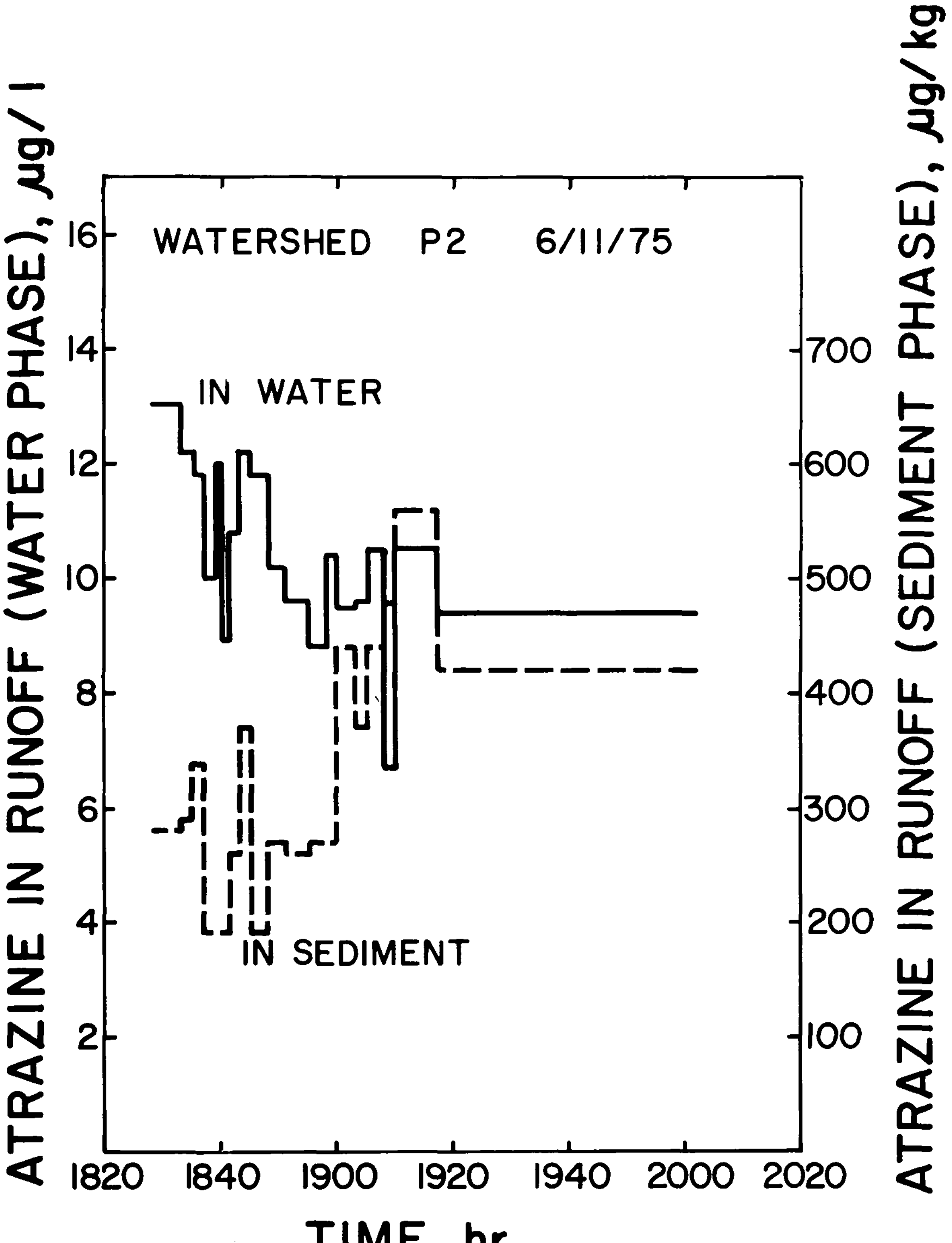


Figure 62. Atrazine in water and sediment phases of runoff, watershed P2, 11 June 1975.

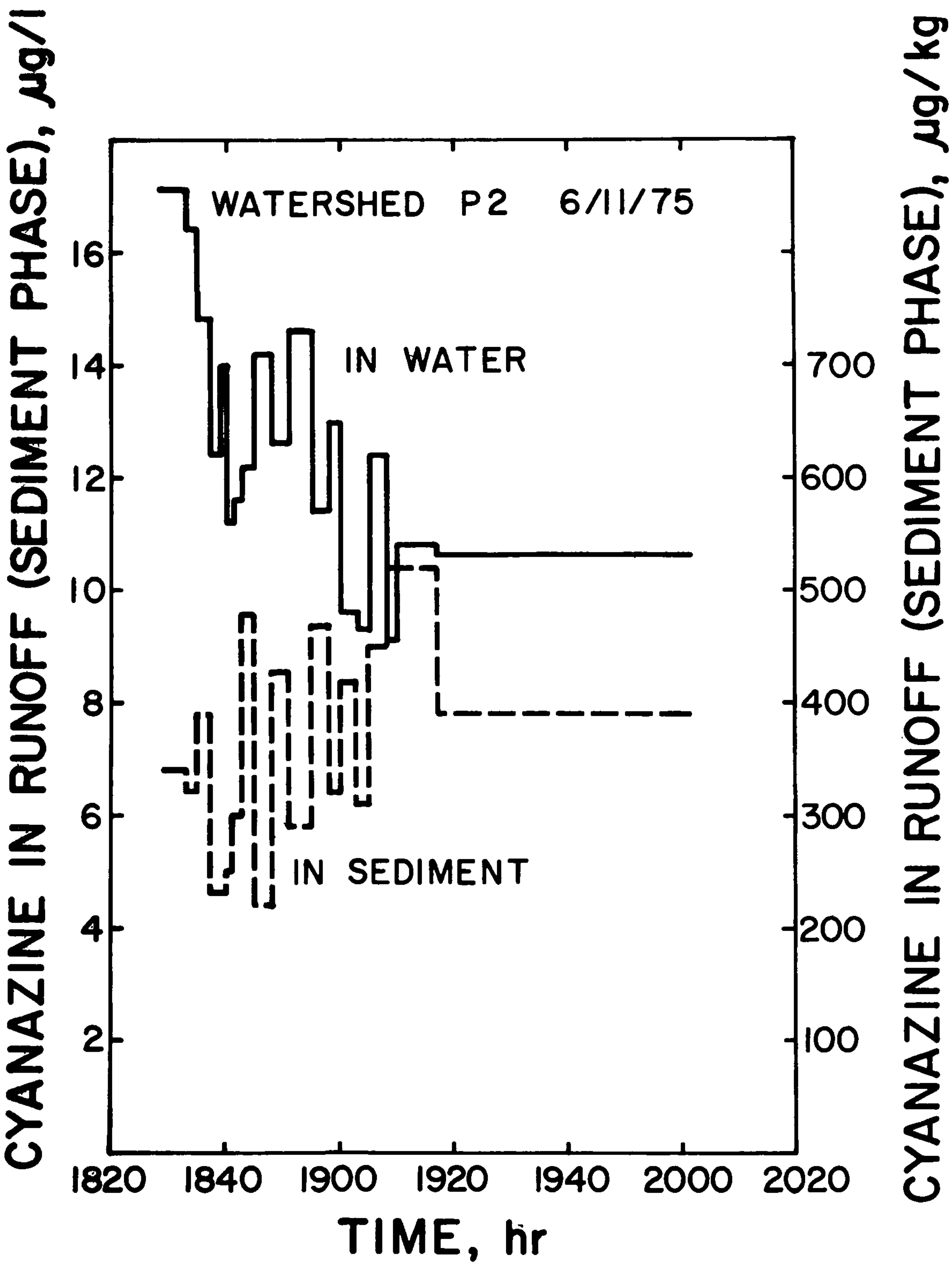


Figure 63. Cyanazine in water and sediment phases of runoff, watershed P2, 11 June 1975.

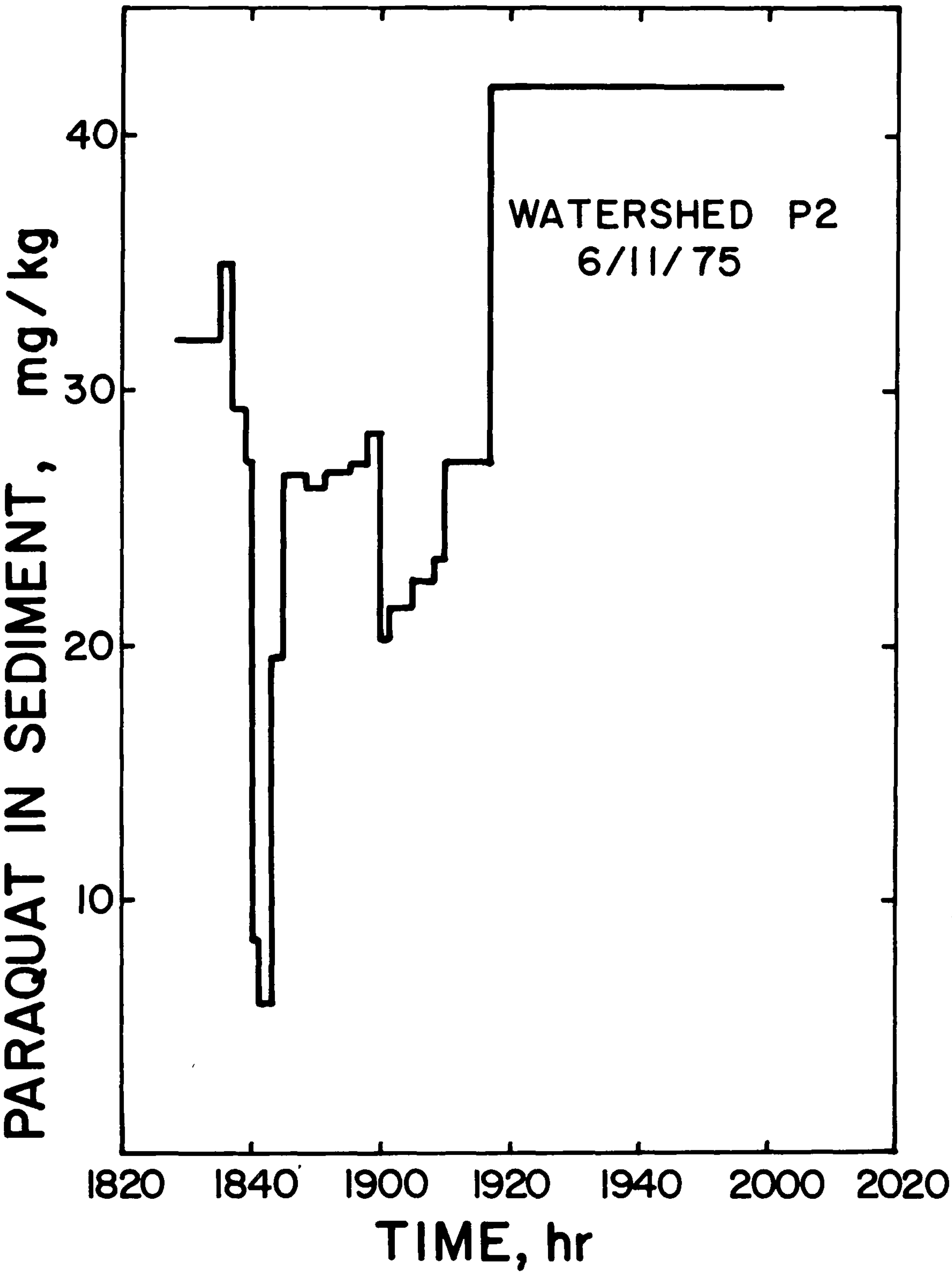


Figure 64. Paraquat in sediment, watershed P2, 11 June 1975.

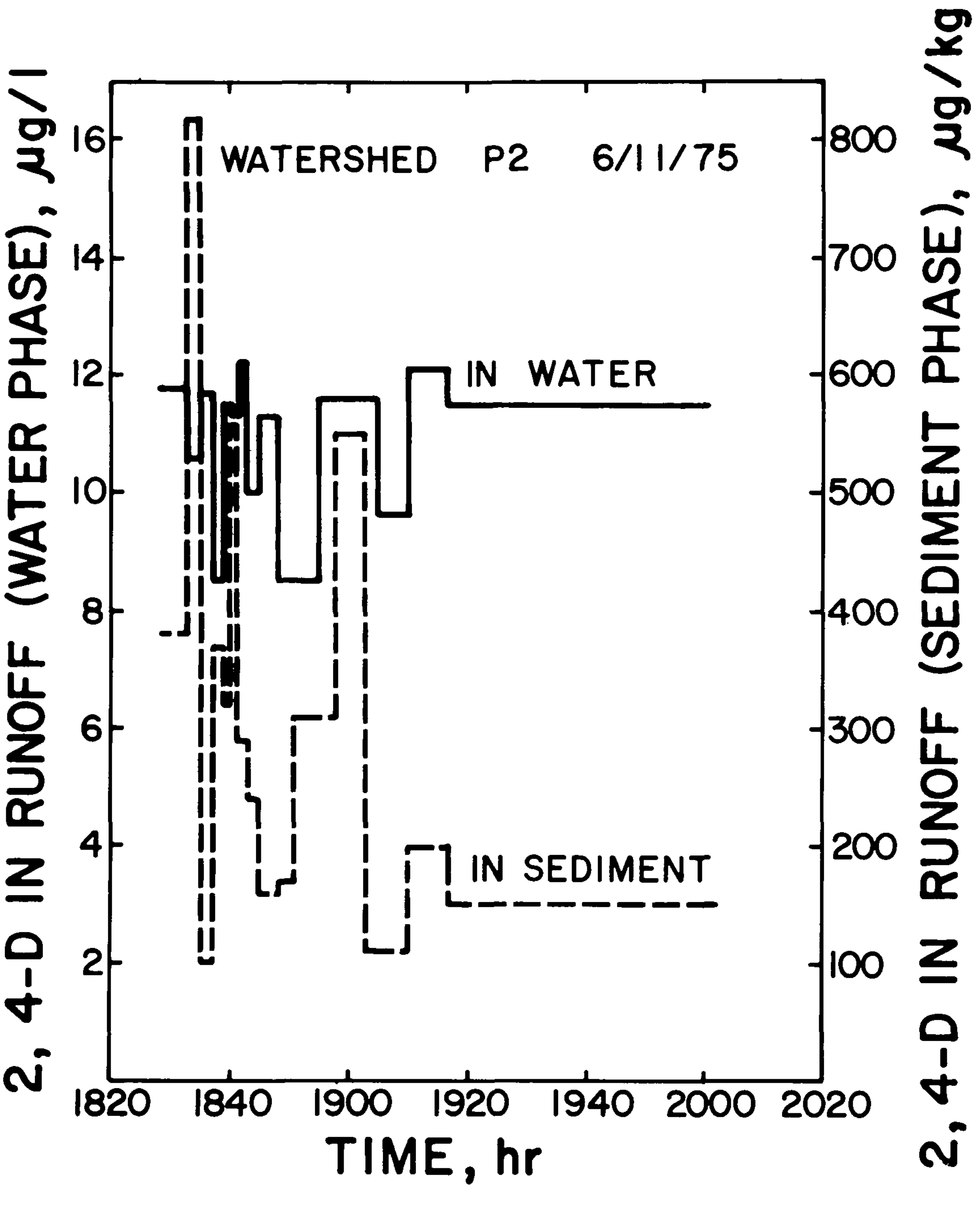


Figure 65. 2,4-D in water and sediment phases of runoff, watershed P2, 11 June 1975.

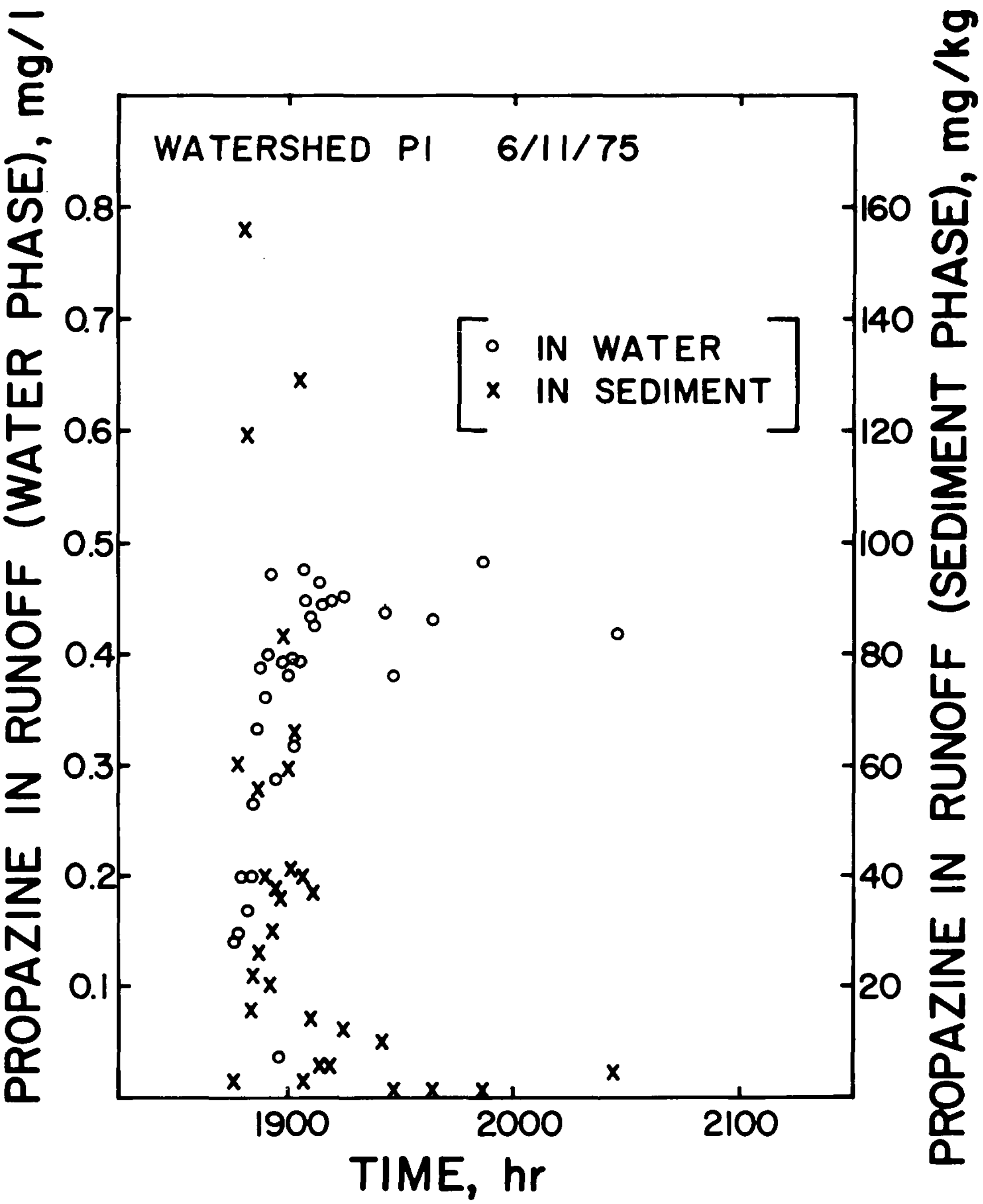


Figure 66. Propazine in water and sediment phases of runoff, watershed P1, 11 June 1975.

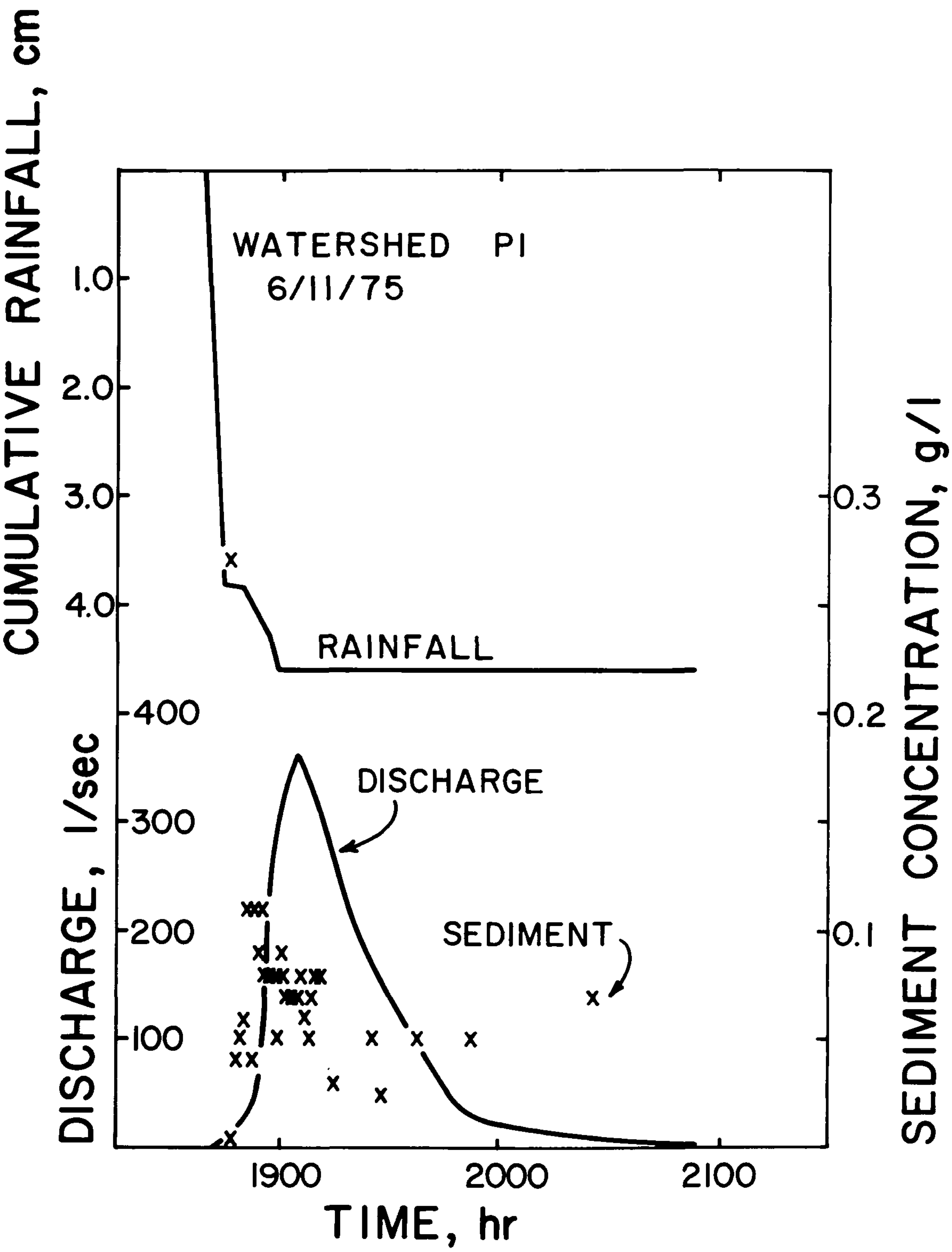


Figure 67. Rainfall, runoff, and sediment concentrations in runoff, watershed P1, 11 June 1975.

much as factors of 2 to 4 with no apparent relationship to time within the storm, runoff stage, or other factors. In the storm of 13 June 1973, however, trifluralin concentrations in water were very high initially and dropped rapidly with time. Initial concentrations in sediment were also higher and declined with time. Because runoff occurred so soon after application, it is possible that these high initial concentrations resulted from transport of the applied emulsion. Paraquat was transported entirely on sediment. In this storm, paraquat concentrations were lowest at peak discharge (Figures 57 and 60). At peak discharge a higher proportion of coarse sediment would be expected, resulting in a lower concentration of the surface adsorbed phase. Except for the first few samples, diphenamid concentrations were high initially and decreased with time after initiation of runoff. Why the diphenamid in the water phase was low in the first few samples even though sediment diphenamid was relatively high cannot be adequately explained. Perhaps in these samples a higher portion of the carrier-bound material was present and partitioned differently between water and sediment. As previously stated, most other storms, and particularly storms subsequent to the first runoff event, gave within-storm concentration distributions in no discernible pattern. This should be expected after redistribution of the materials on the watershed occurred, both vertically in the soil profile and spacially over the watershed surface.

Figures 62 through 65 show the runoff behavior of atrazine, cyanazine, paraquat, and 2,4-D, respectively, during the storm illustrated in Figure 61. This runoff event occurred on watershed P2 on 11 June 1975, 14 days after chemical application. Atrazine and cyanazine were both applied at rates of about 1.5 kg/ha (see details elsewhere in report). Runoff behavior was similar for both compounds, with cyanazine concentrations being slightly higher. Both compounds showed a decrease in concentrations in the aqueous phase with time during the event and an increase in concentrations in sediment phase over the same time period. As discussed previously, most runoff events subsequent to the first major storm after chemical application showed no discernible pattern of concentrations with time within single events. Paraquat in sediment from this storm varied considerably between samples (Figure 64). Whether this reflects a difference in the character of the sediment in the different samples is not known. The lowest paraquat concentrations, however, correspond to maximum discharge where greatest transport of coarse material would be expected. Concentrations of 2,4-D varied greatly between samples in this runoff event, both in sediment and in water with concentrations in sediment varing more than in water.

For all materials studied, concentrations in runoff water (micrograms per liter) were much less than concentrations in sediment (micrograms per kilogram). As will be shown later, however, total mass pesticide transport in the water phase was much greater than in the sediment phase (except for paraquat) because of the much greater mass of water compared to the mass of sediment.

In terms of pesticide concentrations, results from watersheds P3 and P4 were similar to those from watersheds P1 and P2. Sediment concentrations usually were lower and runoff volumes sometimes less, thus affecting total pesticide transport as shown later.

Concentrations of propazine in runoff from watershed P1 in no-till management is shown in Figure 66 for the storm occurring 11 June 1975, 9 days after chemical applications. Compared to sediment in runoff under conventional tillage, sediment concentrations were extremely low (Figure 67). Although there was considerable variability between samples, propazine concentrations in the water phase tended to increase with time in the event, but sediment concentrations decreased with time.

In a previous section it was shown that the persistence of pesticides in the surface layer of soil could be approximated by a pseudo-first-order decay curve. Assuming that the concentration of pesticide in runoff is proportional to the amount present at the soil surface, runoff concentrations would also be expected to decrease from storm to storm exponentially with time after chemical application. Actually, the extraction efficiency of the runoff process should be related to storm characteristics, to the ratio of rill to interrill erosion, to vertical movement during the storm, and to other factors. In order to conveniently show changes in mean storm pesticide concentrations over the growing seasons, however, the simplified assumption above was made. Figures 68 through 71 show the natural logarithm of mean storm concentrations of diphenamid, trifluralin, paraquat, and atrazine, respectively, plotted versus days after application. Visually approximated straight lines were drawn through the point scatter. Regression equations were not obtained because it seemed desirable to give more weight to the early storms in estimating where the lines should be. Although there was considerable scatter from the lines, the fit to logarithmic functions for pesticides in water was as good as could be expected considering that storm characteristics and watershed state were greatly different over the growing seasons. Except for paraquat and atrazine, however, concentrations in sediment with time did not follow any discernible time functions.

Diphenamid concentrations-time functions for runoff from watershed P1 appeared different each year (Figure 68) but extrapolated to the same initial point at application day. In 1973, the runoff event of 11 June produced an actual data point at application day. During 1973, runoff concentrations with time decreased more rapidly than in 1974. From persistence data, the estimated half-life ($t_{½}$) of diphenamid in the 0- to 1-cm zone in 1973 was only 1.3 days compared to 3.6 days in 1974.

The lack of any detectable relationship between sediment diphenamid and sediment trifluralin and time after chemical application (Figures 68 and 69) can possibly be explained by changes in the way these chemicals partition between sediment and water. Over time these compounds may become more tightly bound to soil particles and not desorb as readily in runoff water, that is, moving toward a nonequilibrium on nonsingle value type function. Observations of nonsingular adsorption/desorption[39] would support this hypothesis. Although atrazine concentrations in sediment decreased with time (Figure 71), the decrease was not as rapid as in the water phase, again suggesting that the partitioning between water and the solid phase for atrazine changes with time over the growing season.

Table 19 summarizes pesticide runoff in terms of annual losses in water and sediment by comparing annual totals to amounts applied and illustrates the

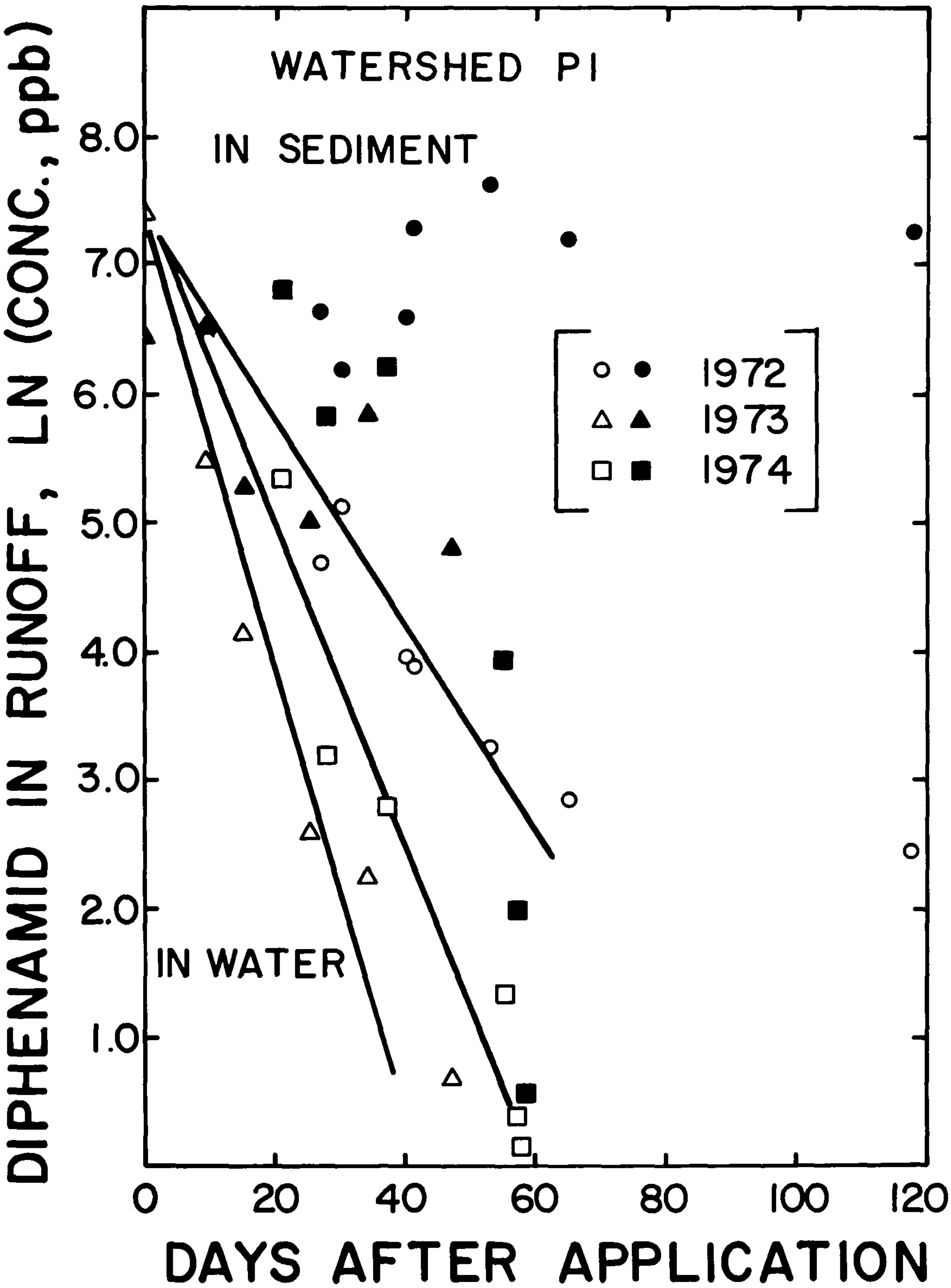


Figure 68. Relationship between diphenamid concentrations in water and sediment phases of runoff and time after application on watershed P1.

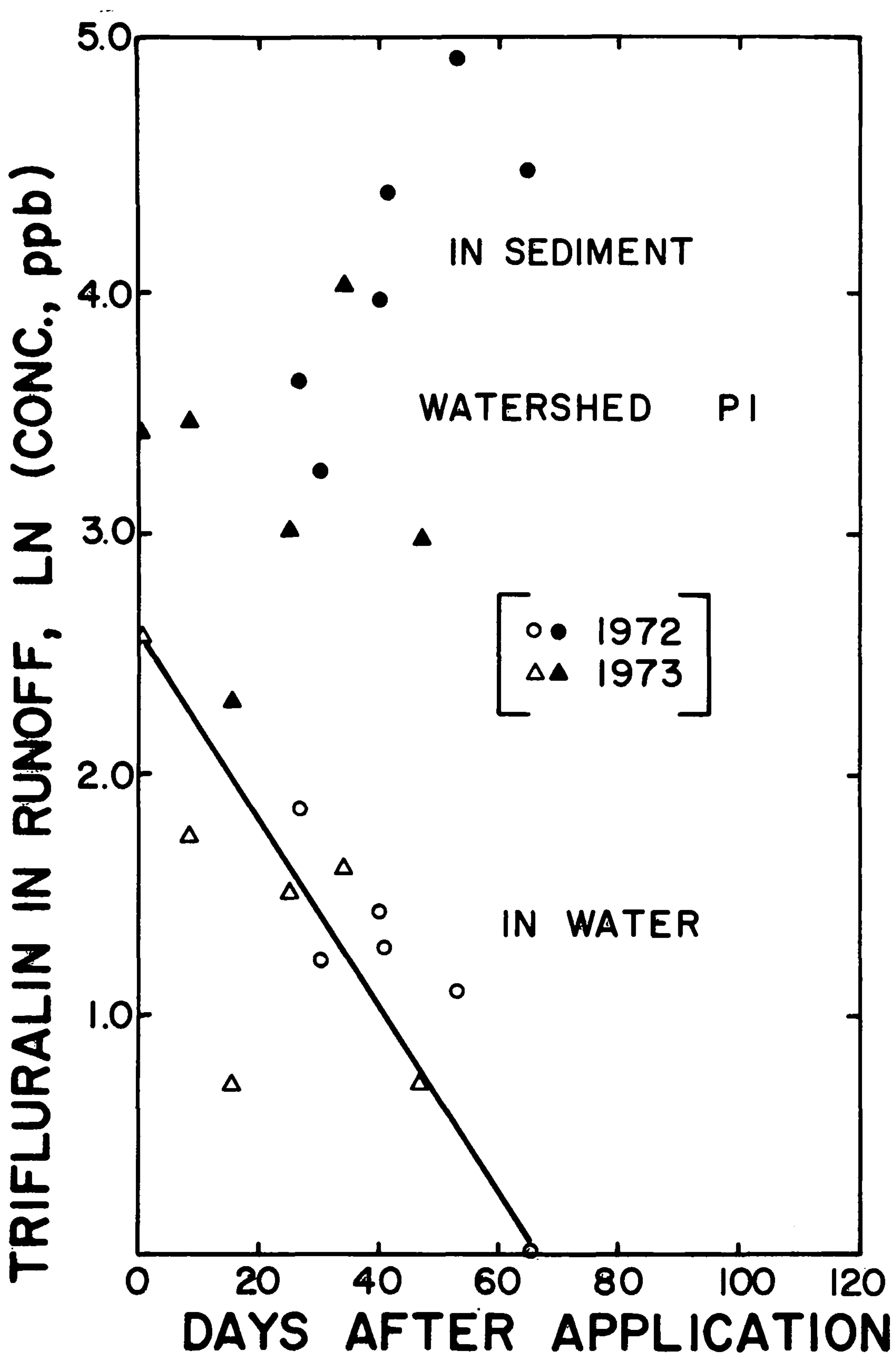


Figure 69. Relationship between trifluralin concentrations in water and sediment phases of runoff and time after application on watershed P1.

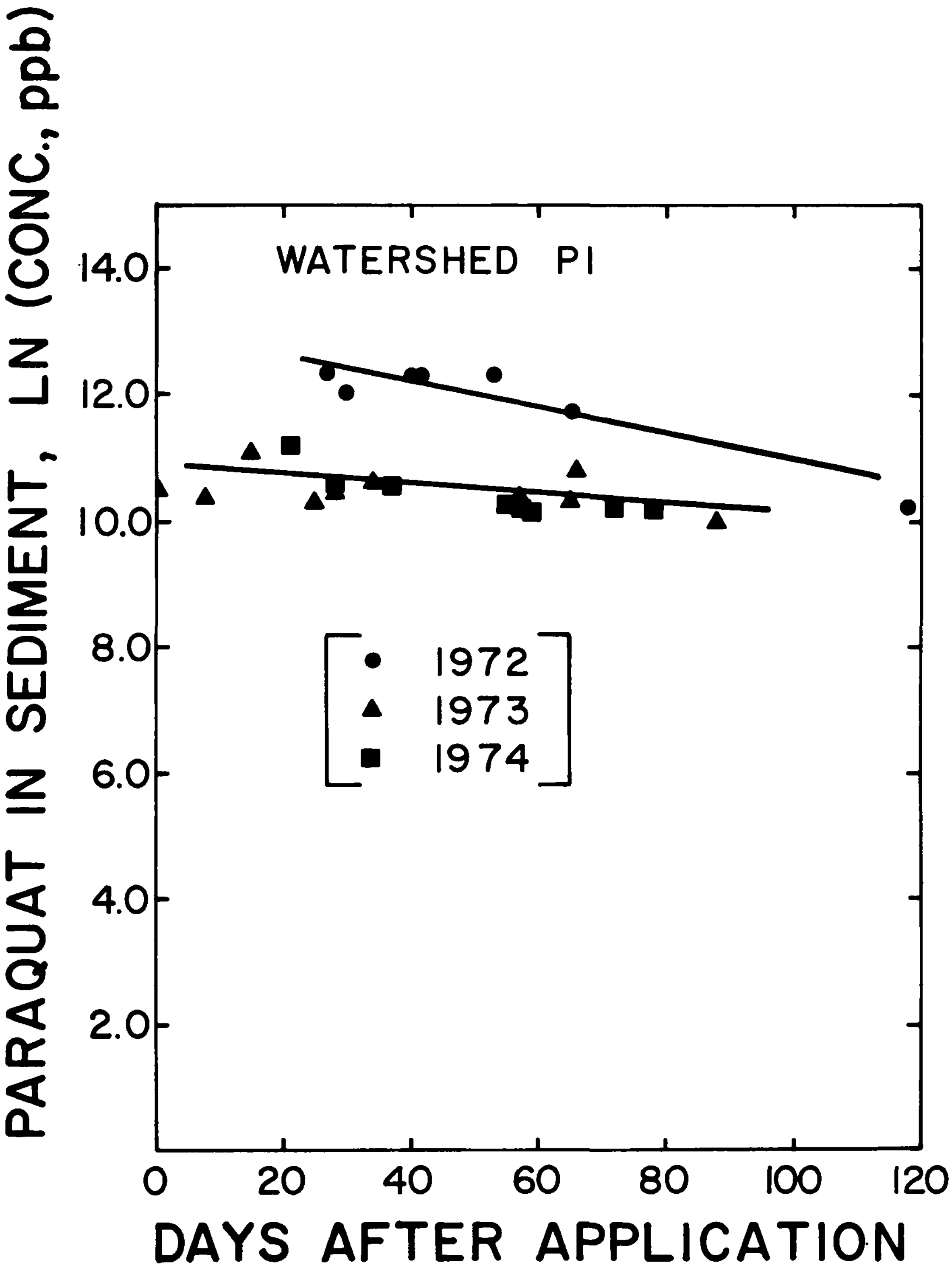


Figure 70. Relationship between paraquat concentrations in sediment phase of runoff and time after application on watershed P1.

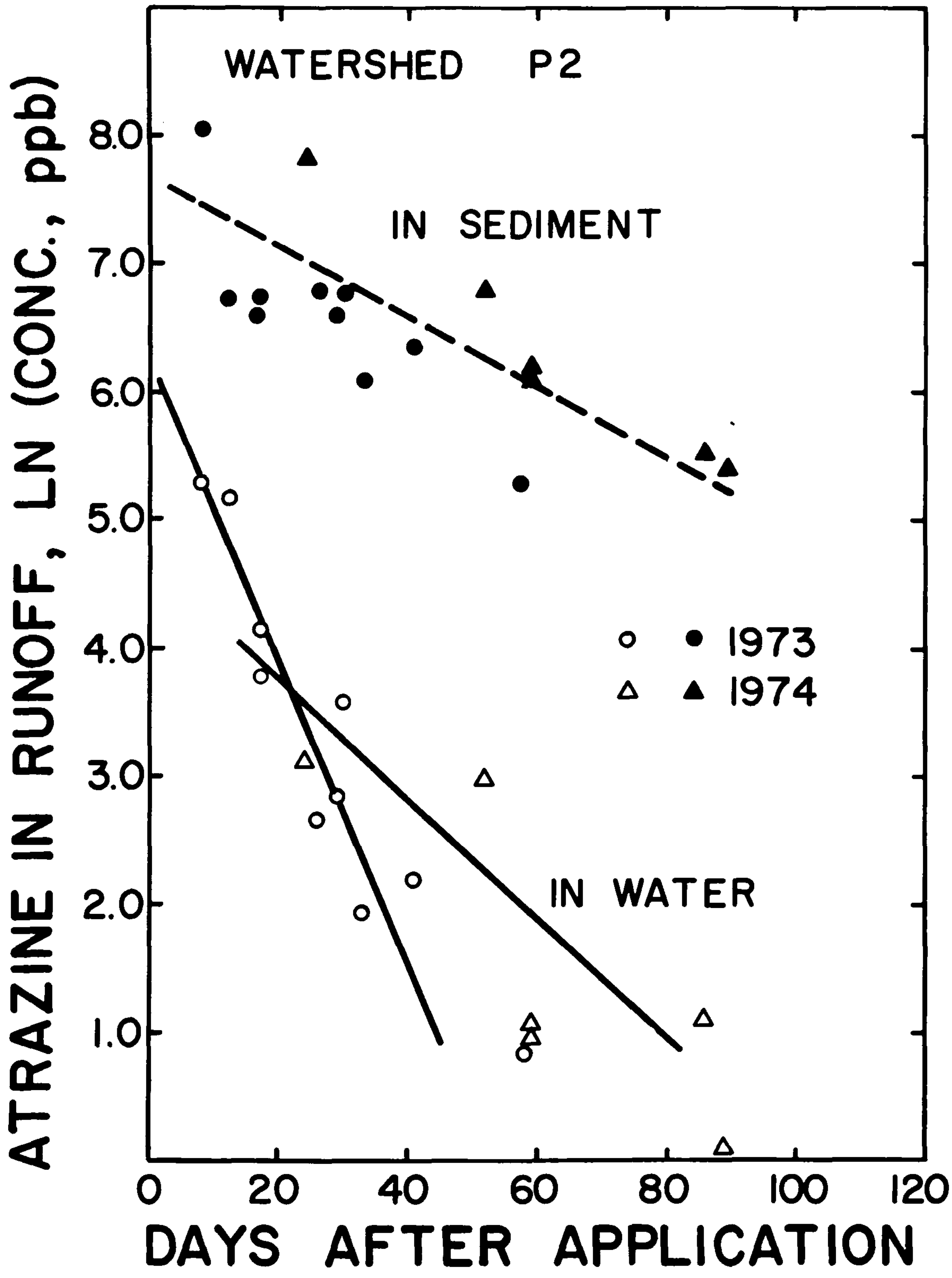


Figure 71. Relationship between atrazine concentrations in water and sediment phases of runoff and time after application on watershed P2.

mode of transport. A more detailed list of losses by storm can be found in Appendix E. As seen in Table 19, percentage loss in runoff on an annual basis was usually small. Percentage annual losses have little significance to water quality as concentrations within a single storm would be the water quality determining factor. These computations, however, are useful in making general comparisons between pesticides, watersheds, and years.

Table 20 shows the ranges in concentration found in runoff, both in water and sediment over the entire study period.

As can be seen in Table 19, except for paraquat, sediment-transported pesticide was small compared with that transported in water. Concentrations, as already shown, were much higher in sediment, but the sediment mass was much smaller than the water mass. Even for trifluralin, a compound with a limited solubility (less than 1 ppm), 89 to 95 percent of the mass lost was in the water phase. The concentrations (1 to 10 ppb) found in runoff water were much less than the maximum solubility, however. The observed partitioning between water and sediment was that present when the laboratory analyses were performed. If equilibration between water and sediment in runoff was strongly time dependent, actual distribution in runoff arriving at the point of measurement may have been somewhat different than inferred for the analyses.

Direct comparisons between watershed and chemicals is difficult because rainfall distributions and pesticide persistence in the runoff zone varied between watersheds and years. The general trend is for a lower percentage of pesticide runoff from watersheds P3 and P4 than from watersheds P1 and P2 as expected because sediment and water yield was also less for P3 and P4. Because land form and management practices affected sediment yield more strongly than water yield, paraquat losses were most strongly affected by watershed properties.

Percentage runoff can be related to pesticide properties and application mode. Losses of trifluralin by runoff were very low. This pesticide was incorporated into the soil and its concentrations at the surface available for runoff were therefore reduced. At the other extreme, paraquat was surface applied, and, because of its adsorption to soil particles and persistence, it remained at the surface of the runoff zone. As expected, relative losses of paraquat were highest of the compounds studied. These losses of paraquat, however, do not represent losses expected for paraquat when applied as recommended, that is, as a contact herbicide at lower rates.

Losses of 7.1 percent of the diphenamid applied to watershed P1 in 1973 illustrates the significance of rainfall occurring in close proximity to application. Most of this loss occurred in the first runoff event, which occurred a few hours after application. The 2 percent diphenamid loss from watershed P3 in 1972 can also be attributed to runoff that occurred 2 days after application. For all other years, losses were less than 1 percent.

Table 21 shows the contributions of the first three runoff events each year for all pesticides to the total seasonal losses. These data clearly show that most of the runoff losses occurred during the first few runoff events for

TABLE 20. RANGES OF PESTICIDE CONCENTRATION IN RUNOFF

Compound	Watershed	Year	Range of compound loss in runoff increments: Water, ppb	Sediment, ppm
Atrazine	P2	1973	2-200	0.2-3.2
		1974	1-1,900	0.2-4.1
		1975	0-101	0-1.5
	P4	1973	1-157	0.1-0.5
		1974	0-324	0-0.5
		1975	5-28	0.2-0.6
Cyanazine	P2	1975	0-181	0-2.3
	P4	1975	2-12	0.1-0.2
Diphenamid	P1	1972	2-176	0-2.0
		1973	0-1,645	0.1-0.6
		1974	0-213	0-0.9
	P3	1972	1-26,432	0-1.7
		1973	0-65	0-0.6
		1974	0-21	0-0.6
		1975	40-73	0-0.8
Paraquat	P1	1972	0-1	23.0-224.3
		1973	0	21.2-61.5
		1974	0	24.6-79.1
		1975*	0	0.4-40.3
	P2	1973	0	4.5-60.5
		1974	0	28.9-1,470.0
		1975	0	19.6-72.2
	P3	1972	0-153	110.0-423.0
		1973	0	38.9-61.2
		1974	0	31.9-47.8
		1975	0	61.3-70.0
	P4	1973	0	12.4-34.3
		1974	0	39.5-49.3
		1975	0	49.6-85.6
Propazine	P1	1975*	15-401	0-21.8
Trifluralin	P1	1972	1-6	0-0.1
		1973	2-13	0-0.1
	P3	1972	2-438	0-0.2
		1973	2-8	0-0.1
2,4-D	P2	1975	0-298	0-2.1
	P4	1975	0-1	0-0

*No-till.

TABLE 21. PERCENT OF TOTAL MASS OF HERBICIDES LOST FROM THE INITIAL THREE POST-PLANT RUNOFF EVENTS

Year	Watershed	Compound	Amount lost in runoff, grams	Amount lost by runoff in first three events, grams	Percent of total runoff loss
1972	P1	Paraquat	2,112.0	1,197.7	56.7
		Trifluralin	3.7	2.2	59.3
		Diphenamid	82.5	60.4	73.2
	P3	Paraquat	657.0	244.5	37.2
		Trifluralin	2.7	0.4	16.4
		Diphenamid	70.4	27.7	39.3
1973	P1	Paraquat	911.2	703.5	77.2
		Trifluralin	7.7	6.1	79.7
		Diphenamid	652.0	648.7	99.4
	P2	Paraquat	216.5	130.3	60.2
		Atrazine	83.7	52.6	62.9
	P3	Paraquat	105.0	100.0	95.0
		Trifluralin	3.2	3.3	100.0
		Diphenamid	25.2	25.1	99.6
	P4	Paraquat	84.8	57.4	67.7
		Atrazine	38.8	34.0	87.6
1974	P1	Paraquat	1,052.9	751.9	71.4
		Diphenamid	25.0	21.7	86.8
	P2	Paraquat	102.0	23.4	23.0
		Atrazine	9.6	6.4	66.9
	P3	Paraquat	73.2	62.9	86.0
		Diphenamid	4.7	4.6	100.0
	P4	Paraquat	24.8	18.0	73.0
		Atrazine	10.7	10.5	98.5
1975	P1*	Paraquat	40.8	40.8	100.0
		Propazine	275.3	275.3	100.0
	P2	Paraquat	236.6	211.0	89.2
		Atrazine	13.9	13.5	97.0
		Cyanazine	20.8	20.4	98.0
		2,4-D	22.0	21.5	98.0
	P3**	Paraquat	20.5	20.5	100.0
		Diphenamid	7.3	7.3	100.0
	P4*	Paraquat	47.6	47.6	100.0
		Atrazine	5.3	5.3	100.0
		Cyanazine	1.3	1.3	100.0
		2,4-D	0.2	0.2	100.0

*Only three events recorded.

**Only two events recorded.

most pesticides. Paraquat losses were more distributed throughout the season than for the others because of its longer persistence.

Adoption of a no-till practice on P1 was very effective in controlling erosion and sediment yield from this watershed. Paraquat (in this instance applied as a contact herbicide but at a somewhat higher concentration than usual) losses were also reduced to less than 1 percent of that applied. Propazine losses were, however, nearly 7 percent of that applied. Essentially, all of these losses (and that of paraquat) occurred in a single storm 3 weeks after herbicide application. This was an intense storm, in which about 4 cm of rain fell in 30 minutes. Therefore, the probability of losses of the magnitude measured in 1975 on watershed P1 may be low.

PLANT NUTRIENT MOVEMENT IN SOILS

Chloride and Nitrates

Chloride and nitrate-N soil profile concentrations are presented in Figures 72 through 77. These data represent 13 sets of core samples (0 to 152 cm) over three spring-summer crop growing seasons. Although profile movement patterns were similar for both anions in many instances, direct comparisons cannot be made because of variable application rates and dates. The bulk of the N-fertilizer was applied at recommended rates during the corn growing season. High background levels of chloride below the 75-cm depths distorted patterns of apparent movement in many cases. Total rainfall and runoff between sampling periods are listed near the bottom of each chloride and nitrate-soil profile. The difference between these values represents water available for infiltration and evapotranspiration (ET). During April and May 1974, considerably less water was available for infiltration following chloride and nitrate fertilizer application. Consequently, movement patterns are best depicted during the 1974 spring-summer growing season. Some nitrification following application of N-fertilizer was evident on 20 April and 8 July 1974. In 1975, rainfall was approximately 30 cm above normal and moderately well distributed. As a result, a progressive movement of anions was not clearly depicted in the data from the 1975 summer season.

Neither rainfall variation between watershed sites nor winter rye cover crops grown on watershed P4 appear to influence soil profile concentration levels or distribution significantly. Exploratory deep core sampling down to 600 cm indicated no NO_3-N peaks above 5 ppm below 175 cm. Chloride concentrations tapered off to approximately 10 ppm below 375 cm. The annual application rate of 112 kg Cl/ha from a KCl fertilizer source is higher than is normally used in the Southern Piedmont. In terms of concentrations, the contribution of Cl and NO_3-N to subsurface waters appeared minimal even when excessive leaching occurred during winter months. Chlorides and NO_3-N concentrations remaining in the 0- to 152-cm soil profile decreased only slightly during the 30 October 1974 to 23 April 1975 sampling interval. Approximately 70 cm of rainfall was available for leaching during this period because of expected low ET rates.

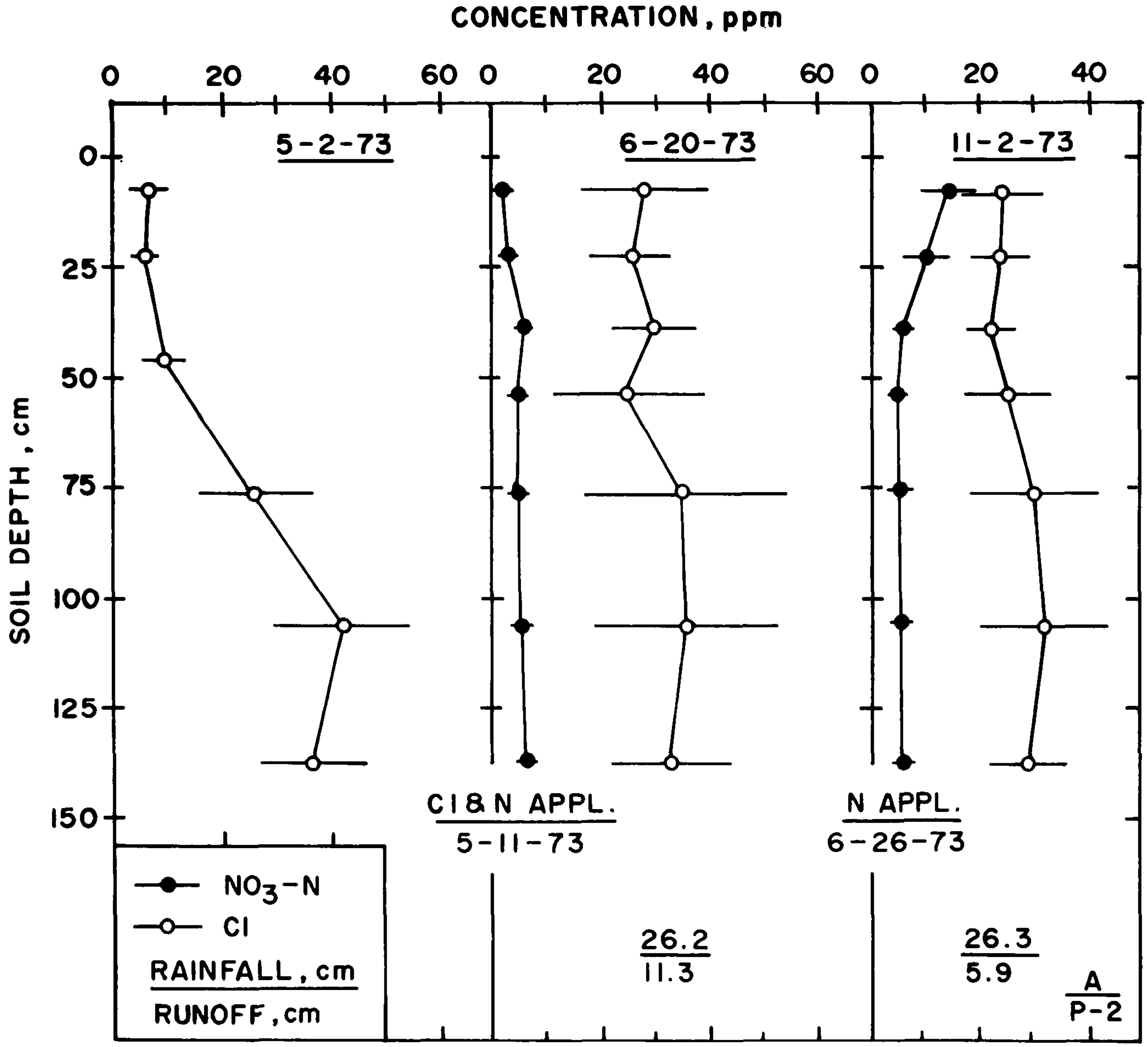


Figure 72. Soil chloride and nitrate-N concentration depth profiles, watershed P2, 1973.

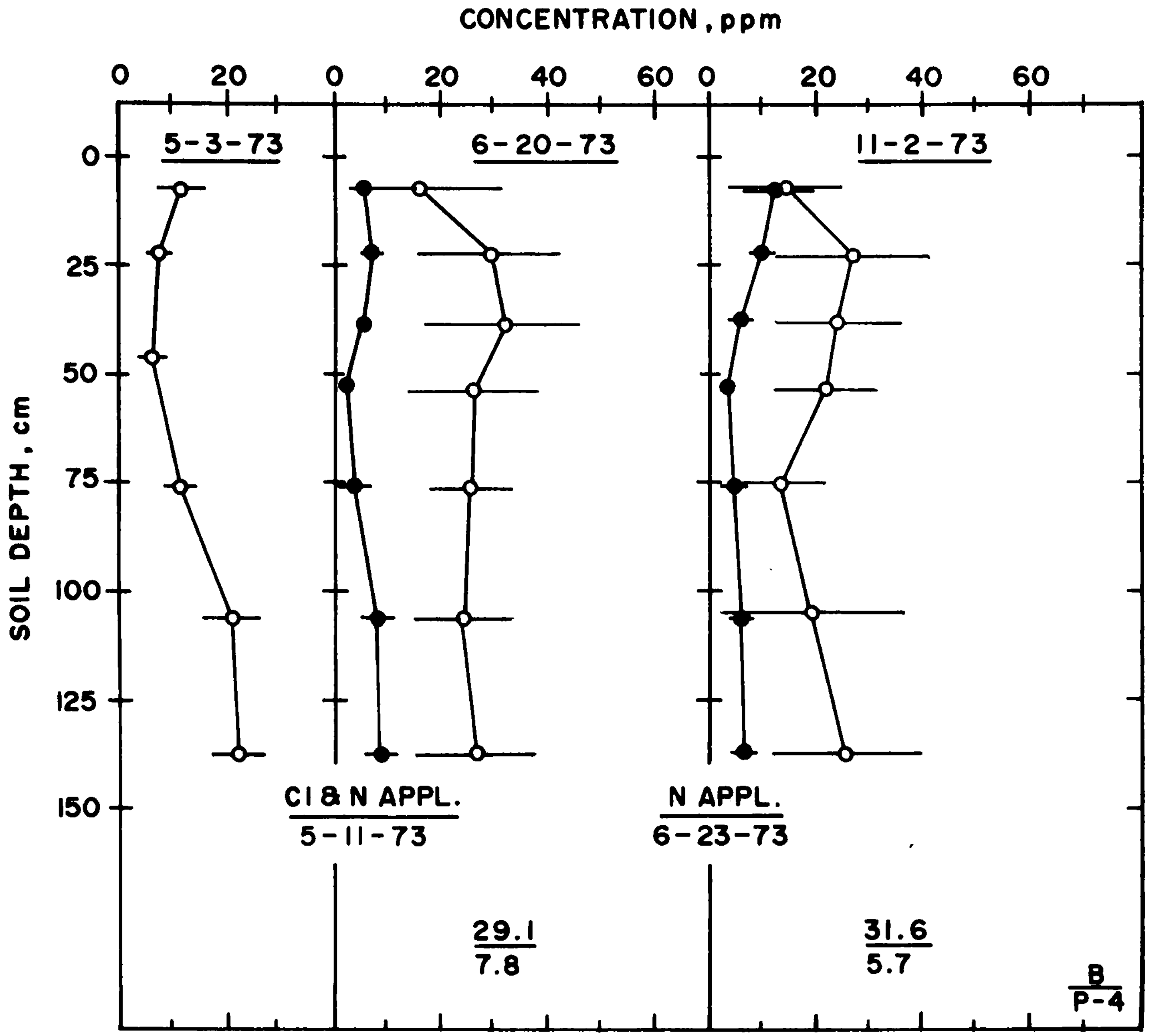


Figure 73. Soil chloride and nitrate-N concentration depth profiles, watershed P4, 1973.

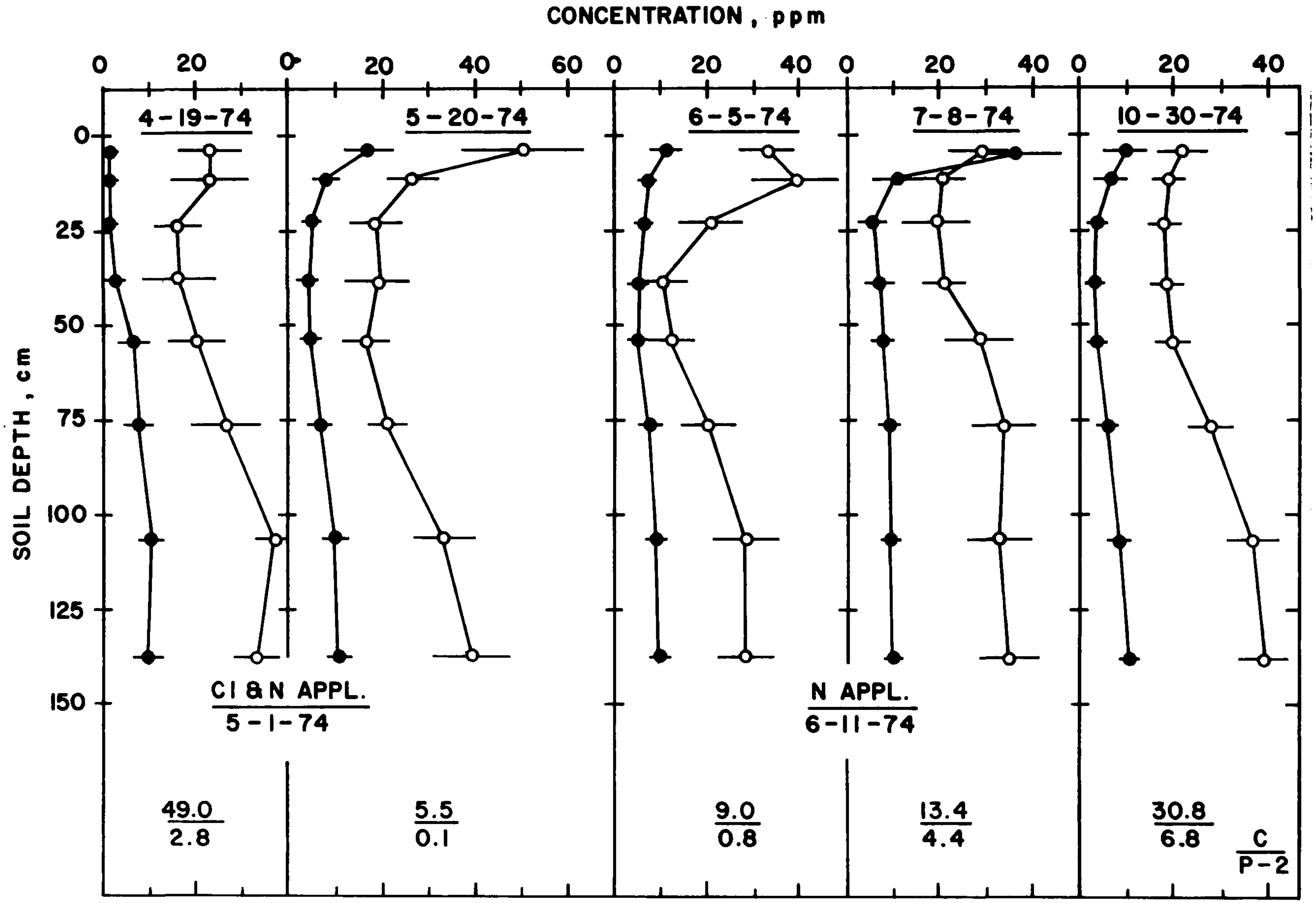


Figure 74. Soil chloride and nitrate-N concentration depth profiles, watershed P2, 1974.

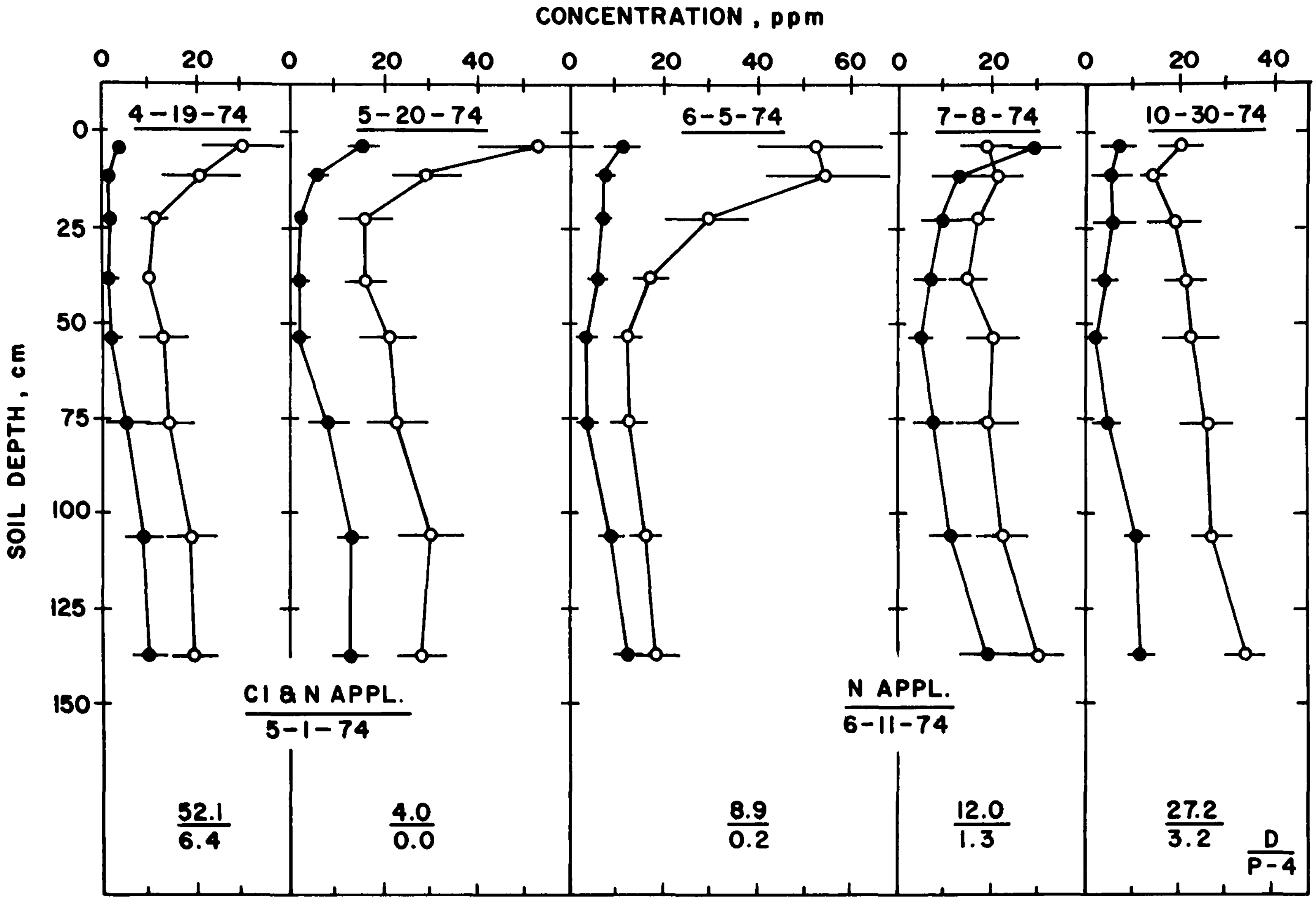


Figure 75. Soil chloride and nitrate-N concentration depth profiles, watershed P4, 1974.

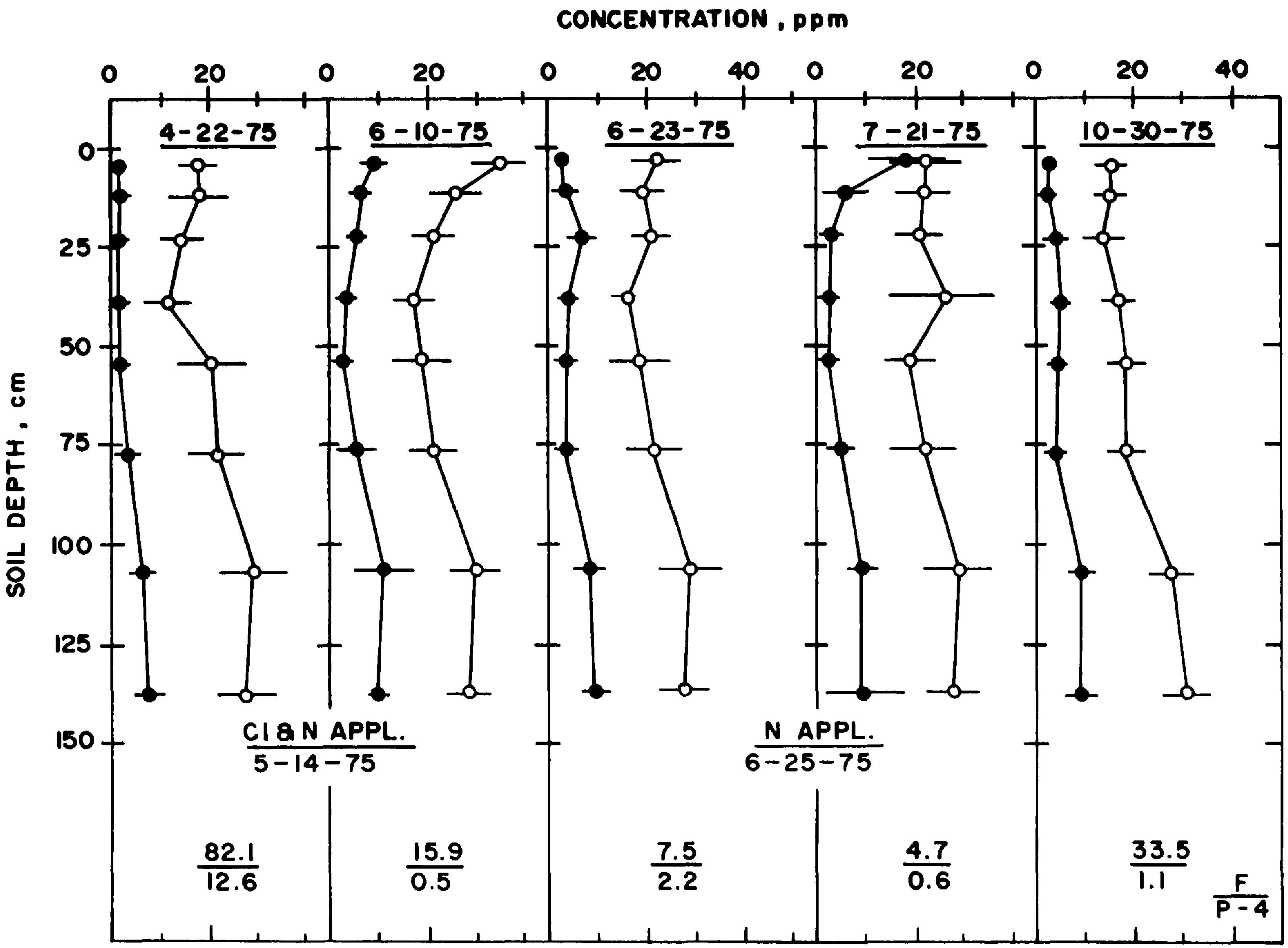


Figure 76. Soil chloride and nitrate-N concentration depth profiles, watershed P2, 1975.

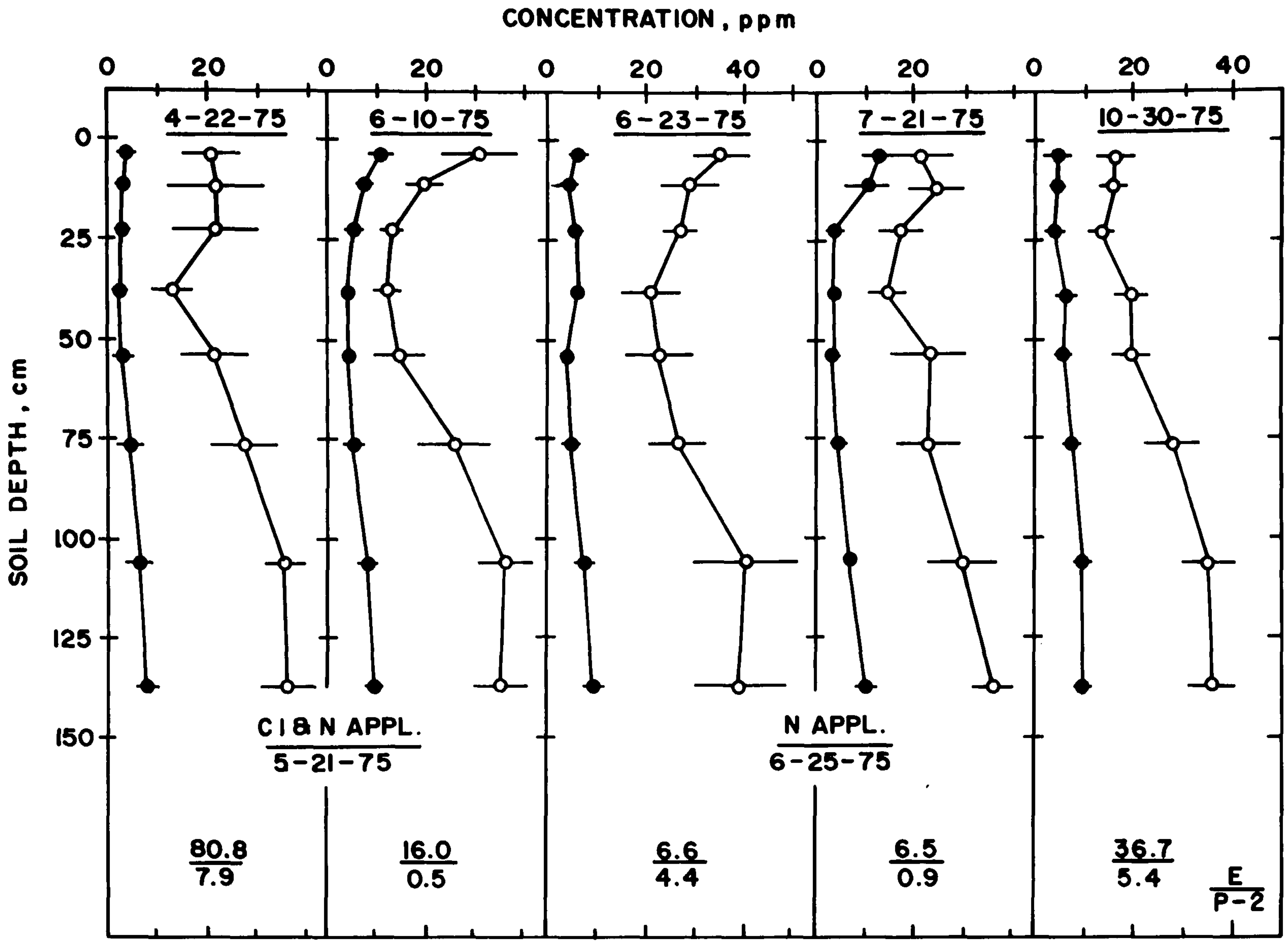


Figure 77. Soil chloride and nitrate-N concentration depth profiles, watershed P4, 1975.

One objective of this phase of the overall study was to assess the potential for mobile fertilizer elements to enter surface runoff. The availability of chloride for overland transport is described well in the curve shown in Figure 78. Annual points appear related to rainfall quantities and patterns. Rainfall and crop uptake were sufficient each year to diminish chloride concentrations to 35 ppm or less in the top 8 cm of soil within 40 days following application. These data show that considerable redistribution of mobile anions occurred within the soil in response to rainfall. Although concentration values approached an asymtotic position approximately 40 days following each chloride-fertilizer application, concentrations in the topsoil did not decrease to original background levels. Nitrates did not behave in this manner because of nitrification and multiple applications of N-fertilizer.

Quantities of Cl and NO_3-N remaining in the 0- to 152-cm depth interval (Figure 79) at each soil sampling suggested that more than 1 year was required to move a 112 kg Cl/ha application through this zone of soil. Bulk density values for each sampling depth were used to calculate chemical mass.

The influences of crop residues and rainwater contributions to soil Cl and NO_3-N are not readily detectable. These components, however, do account for a fraction of the anions remaining in the soil profile. Data in Table 22 indicate that considerable total nitrogen is either recycled through crop residues or removed in corn grain. On the double-cropped watershed, P4, 84 kg N/ha was available for mineralization, whereas 57 kg was removed in corn grain. Very little chloride was recycled or removed by corn or rye crops, however. Approximately 5.0 kg of NO_3-N and NH_4-N per hectare was added through rainwater as well as 6.0 kg Cl/ha annually. Quantities of nitrogen recycled through crops (Table 22) probably accounts for the more constant soil NO_3-N mass as shown in Figure 79.

For a given watershed sampling, concentrations of both Cl and NO_3-N varied considerably among cores removed at different locations on the watersheds. These variations produced the standard errors of means indicated by horizontal line segments plotted in Figures 72 through 77. Work of McMahon and Thomas[40] shows that large sampling errors may be incurred. Much of the variation in spatial distribution of Cl and NO_3-N observed in this study, however, can be related to physical differences in soil properties with respect to watershed position. Differences in Cl and NO_3-N distribution by watershed sampling area is illustrated in Tables 23 through 26. These results are from samples taken on 20 June 1974, 19 days after application of Cl and mixed fertilizer at planting.

The depth to the top of the B2 soil horizon varied from approximately 10 to 100 cm on watershed P2 (Figure 10); almost no variation in the B2 horizon was observed on the P4 watershed. Surface texture, however, varied on both watersheds (Tables A2 and A4). Using partial regression, Cl remaining in the surface 46 cm (on 20 June 1974) was statistically related to the above textured surface thickness variable as well as surface slope. Only the depth of the B2 horizon correlated significantly on P2 (Table 27); however, surface texture apparently became more important to initial anion movement when the depth of the B2 horizon was not variable on watershed P4. Actually, depth to

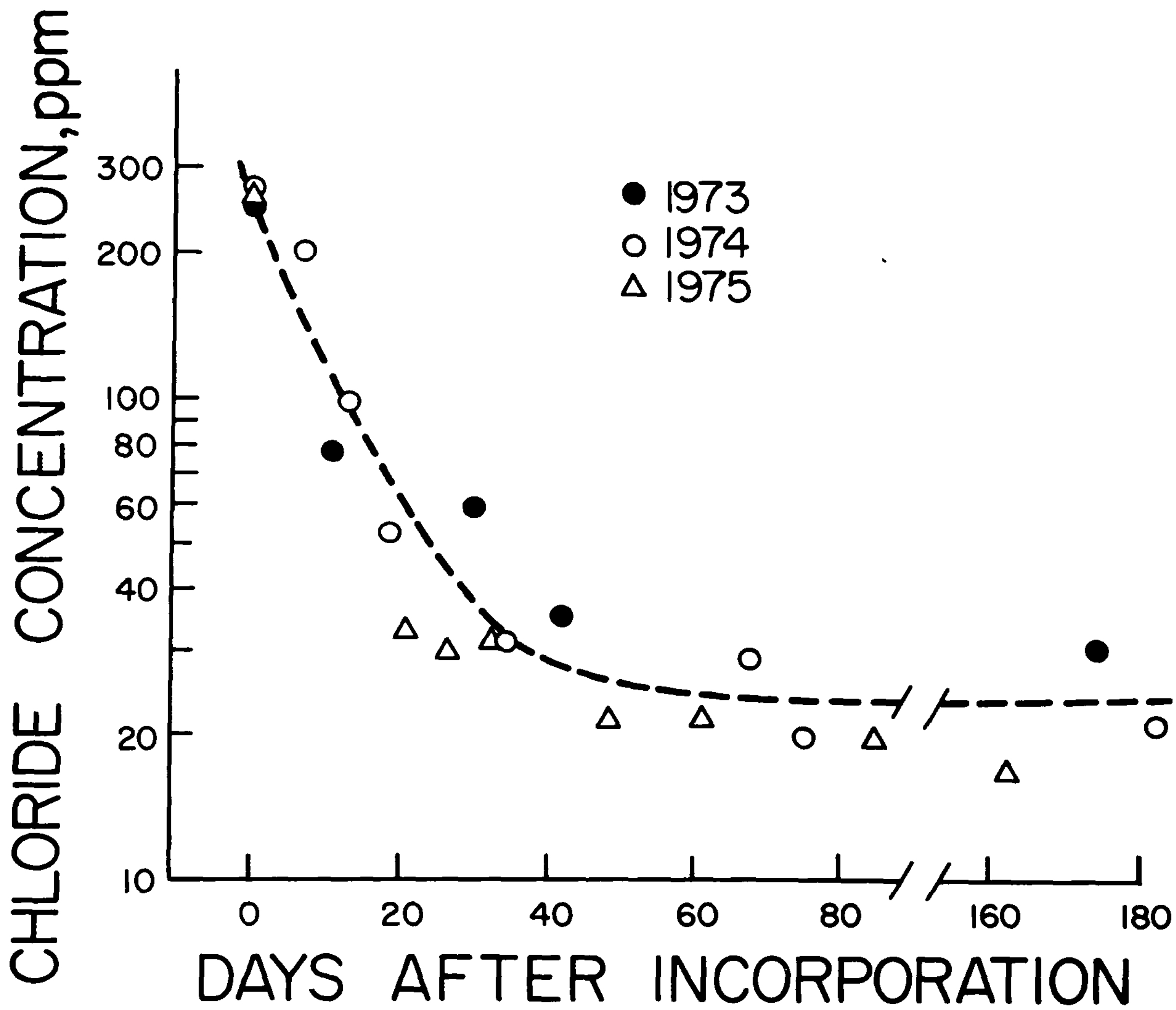


Figure 78. Average chloride concentrations in the top 0 to 8 centimeters of soil following spring application of fertilizer.

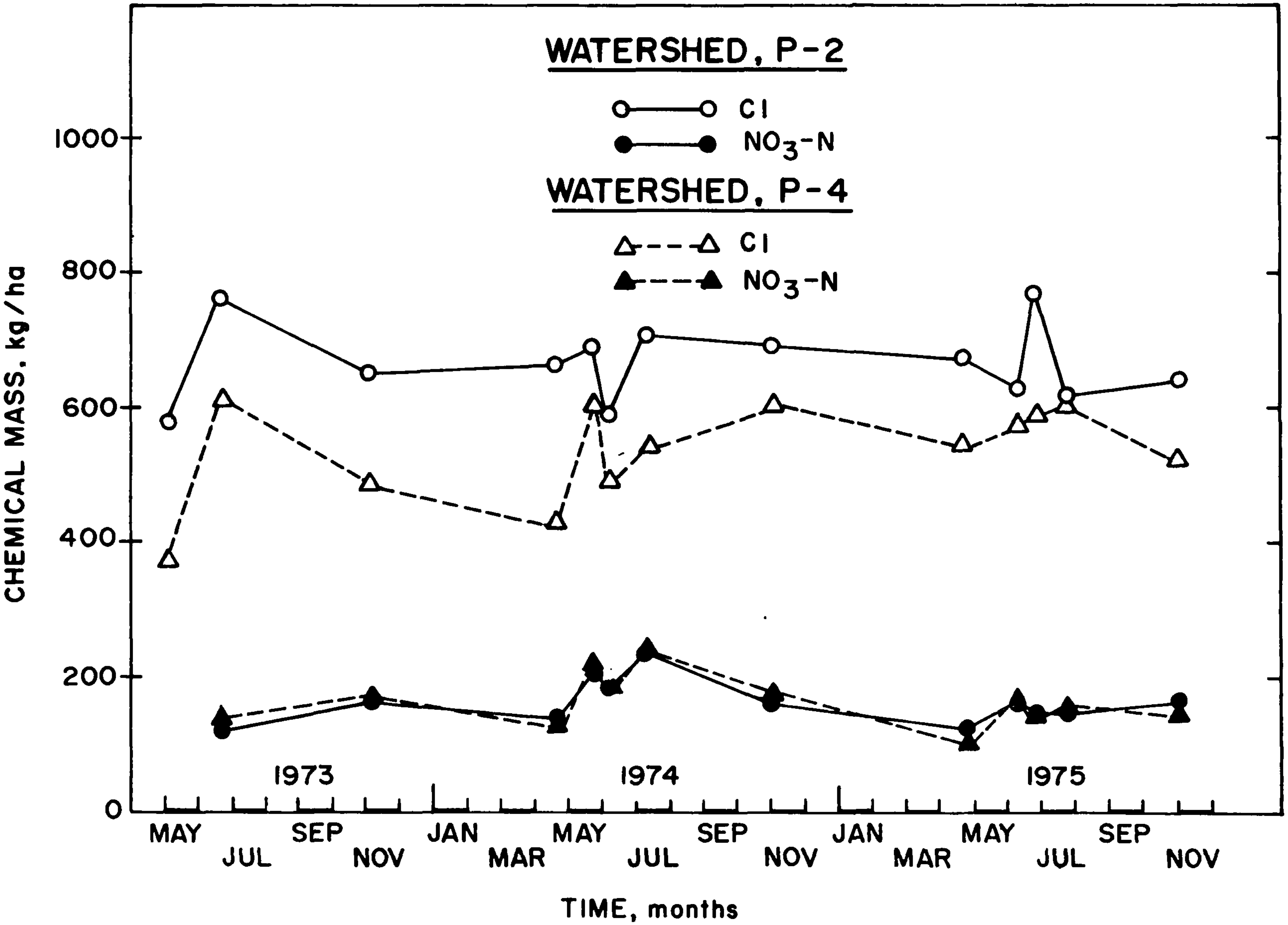


Figure 79. Average quantities of chloride and nitrate-N remaining in the 0 to 152 centimeter depth zone at each sampling.

TABLE 22. AVERAGE ANNUAL RECYCLING OF NITROGEN AND CHLORIDE THROUGH CROP GRAIN AND RESIDUES

Crop components	Average crop production	Element content,* percent		Element uptake kilograms per hectare	
		N	Cl	N	Cl
Corn grain	4,100	1.39	0.04	57	1.6
Corn stover	6,700	0.94	0.28	63	18.8
Rye hay (P4)	2,000	1.07	0.22	21	4.4

*Morrison, F. B. Feeds and Feeding. The Morrison Publishing Company, Ithaca, New York. 1956.

TABLE 23. QUANTITIES OF CHLORIDE (kg/ha) REMAINING IN THE 0-152 cm DEPTH ON 20 MAY 1974, WATERSHED P2

Soil depth, cm	Sampling areas 1	2	3	4	5	6	7	8	9	10
0-8	43	44	74	43	48	49	58	39	39	34
8-15	41	23	30	26	19	53	32	26	24	25
15-30	41	30	66	38	41	97	31	43	44	43
30-46	43	32	52	23	21	64	36	51	50	27
46-61	67	30	38	32	24	47	59	37	49	23
61-91	105	106	145	72	86	113	146	119	76	63
91-122	148	193	262	140	139	204	188	199	116	123
122-152	177	196	218	268	181	263	179	85	275	124
Total	665d*	654d	885f	642cd	559b	890f	729e	599bc	673d	462a

*Means followed by the same letter are not significantly different at the 5 percent level of significance.

TABLE 24. QUANTITIES OF NITRATE-N (kg/ha) REMAINING IN THE 0-152 cm DEPTH ON 20 MAY 1974, WATERSHED P2

Soil depth, cm	Sampling areas 1	2	3	4	5	6	7	8	9	10
0-8	26	14	46	12	14	13	16	16	56	15
8-15	9	8	8	9	9	10	7	13	18	7
15-30	19	7	9	10	13	20	8	17	12	7
30-46	25	3	10	7	7	21	5	9	6	5
46-61	28	6	15	10	7	14	13	9	4	3
61-91	44	29	50	22	33	32	46	32	16	18
91-122	80	45	78	49	49	59	65	41	34	36
122-152	33	45	58	57	55	64	68	35	67	33
Total	264ef*	157ab	274f	176bc	187bcd	233def	218cde	172abc	213cde	124a

*Means followed by the same letter are not significantly different at the 5 percent level of significance.

TABLE 25. QUANTITIES OF CHLORIDE (kg/ha) REMAINING IN THE 0-152 cm DEPTH ON 20 MAY 1974, WATERSHED P4

Soil depth, cm	Sampling areas 1	2	3	4	5	6	7	8	9	10
0-8	53	46	65	66	101	46	76	86	52	57
8-15	57	23	31	30	42	42	44	30	30	44
15-30	35	18	20	35	88	43	44	32	38	49
30-46	25	26	27	28	71	52	21	25	42	22
46-61	49	75	24	42	61	43	38	43	43	19
61-91	72	48	102	92	170	63	107	133	159	115
91-122	194	101	76	250	229	123	145	148	140	53
122-152	119	117	100	174	207	107	95	178	132	74
Total	604abc*	454a	445a	717c	969d	519ab	570abc	675bc	636bc	433a

*Means followed by the same letter are not significantly different at the 5 percent level of significance.

TABLE 26. QUANTITIES OF NITRATE-N (kg/ha) REMAINING IN THE 0-152 cm DEPTH ON 20 MAY 1974, WATERSHED P4

Soil depth, cm	Sampling areas 1	2	3	4	5	6	7	8	9	10
0-8	20	19	16	16	19	22	20	22	21	1
8-15	7	9	7	6	9	8	8	8	8	1
15-30	6	4	3	4	7	6	8	7	7	3
30-46	4	4	4	2	4	8	4	4	4	2
46-61	4	4	3	3	3	3	7	4	4	3
61-91	34	27	31	22	81	11	20	47	54	20
91-122	48	63	38	80	86	55	55	63	86	31
122-152	44	70	41	67	88	58	78	38	62	16*
Total	167b†	200bc	143b	200bc	297d	171b	200bc	193bc	246cd	77a

*Fescue grass waterway.

†Means followed by the same letter are not significantly different at the 5 percent level of significance.

TABLE 27. EFFECT OF SOIL VARIABLES ON THE ACCUMULATION OF CHLORIDE ABOVE THE B2 HORIZON (0-46 cm) ON WATERSHEDS P2 AND P4, 20 MAY 1974

Independent variable	Chloride (kg/ha) above B2 horizon: Partial regression coefficients (b_i)	Level of significance
Watershed P2		
Percent slope	-0.0472	NS*
Depth to B2 horizon	-0.5062	S1
Percent lay of Ap horizon	+0.0815	NS
Percent clay of B2 horizon	-0.1528	NS
Watershed P4		
Percent clay of Ap horizon	+0.3526	S5
Percent clay of B2 horizon	-0.0447	NS

*Note: NS = Not significant.
S1 = Significant at 1 percent level.
S5 = Significant at 5 percent level.

the B2, surface texture, and slope probably were not independent variables but were treated as such statistically. No statistically significant relationship could be developed for NO_3-N, probably because of the method of N-fertilizer application as well as biological transformations and plant uptake. More frequent soil sampling to depths greater than 152 cm probably would be required to develop statistically significant relationships below 46 cm in the Southern Piedmont with Cl movement.

Results from core sampling, as described above, were segregated into three groups of surface textured ranges and three groups of surface thicknesses (depth to B2). Average Cl distribution with depth for the three surface thickness classes on P2 and the three textured classes on P4 are plotted in Figures 80 and 81. These plots illustrate how soil properties as shown statistically above affected the initial redistribution of applied Cl.

Retention of anions on positively charged sites in acid soils has been reported.[41] Differences in apparent Cl and NO_3-N movement in soils on watersheds of this study, however, are thought to mainly reflect differences in water infiltration and redistribution as affected by soil and position on the landscape. However, observations that Cl in the upper portion of the soil profile did not drop to original background levels even after long periods of potential leaching may indicate some anion retention on positively charged sites.

Appendix F may be consulted for details of the data illustrated here.

NITROGEN, PHOSPHORUS AND CHLORIDE IN RUNOFF

Concentrations of Cl and NO_3-N found in runoff during a typical thunderstorm such as the one occurring on watershed P2 on 11 June 1975 are shown in Figure 82. This storm will be discussed for illustration of typical data. Detailed data by storm totals can be found in Appendix H. Rainfall, runoff rates, and sediment concentration for this same storm are given in Figure 61. Concentrations of both Cl and NO_3-N were higher in the early portion of the event and decreased sharply with time. This behavior was observed only in runoff during those initial storms occurring after fertilizer application. After surface concentrations decreased, runoff concentrations were much less than in Figure 82 and in general did not follow a definite pattern related to time within a storm or discharge rate.

Ammonia-N concentrations in both filtered and unfiltered samples decreased with time within the same storm (Figure 83). Most of the transported NH_4^+-N was apparently attached to sediment as reflected by the large differences in concentrations between the filtered and unfiltered samples. Sediment concentrations within the storm were greatest at peak discharge and decreased as runoff decreased (Figure 61). Ammonia-N concentrations in the unfiltered samples as shown here were directly related to suspended sediment.

As expected, total P in unfiltered samples was strongly related to suspended sediment (Figure 61), sediment being a principal transport vehicle

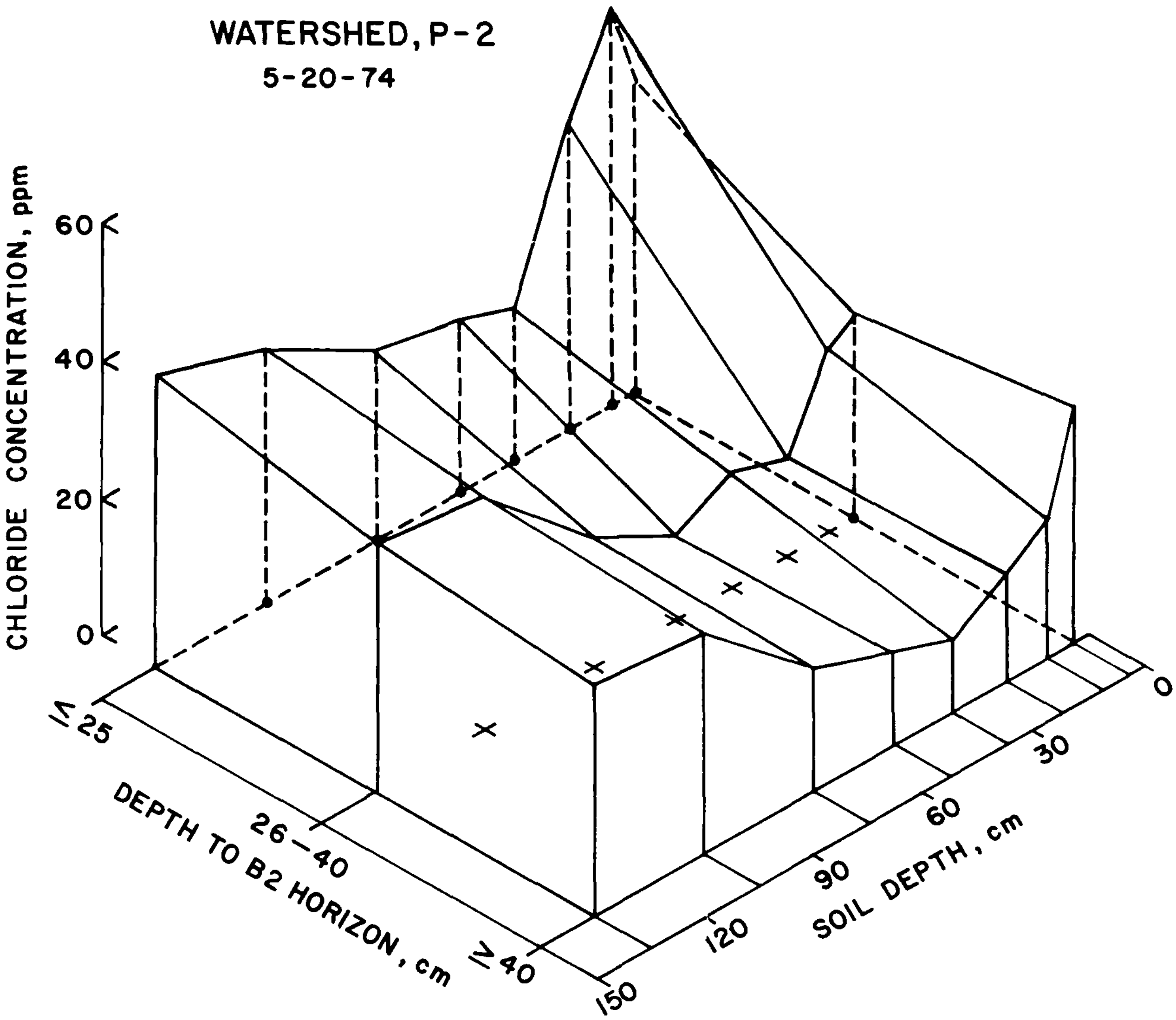


Figure 80. Average chloride depth distribution for three thickness classes.

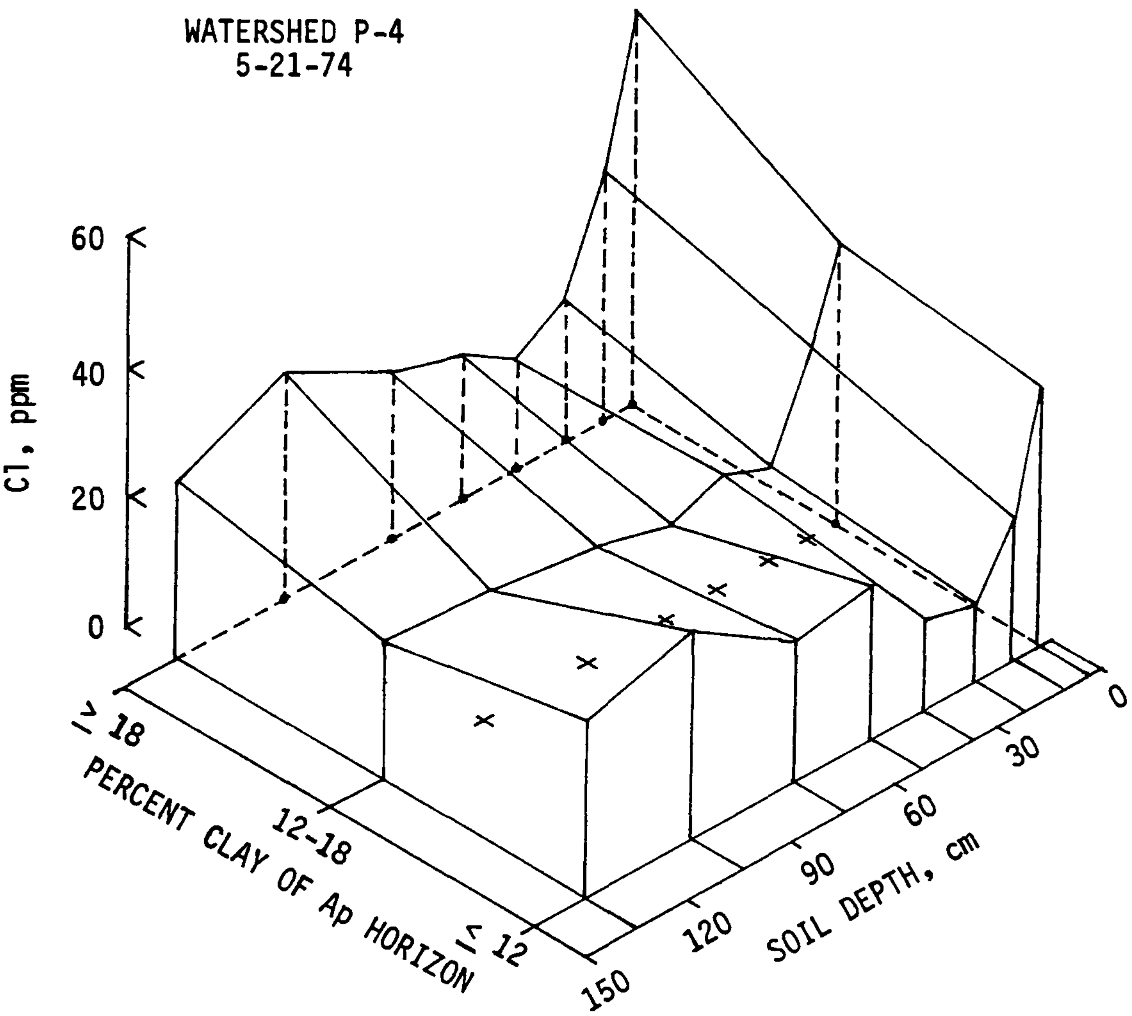


Figure 81. Average chloride depth distribution for three textural classes.

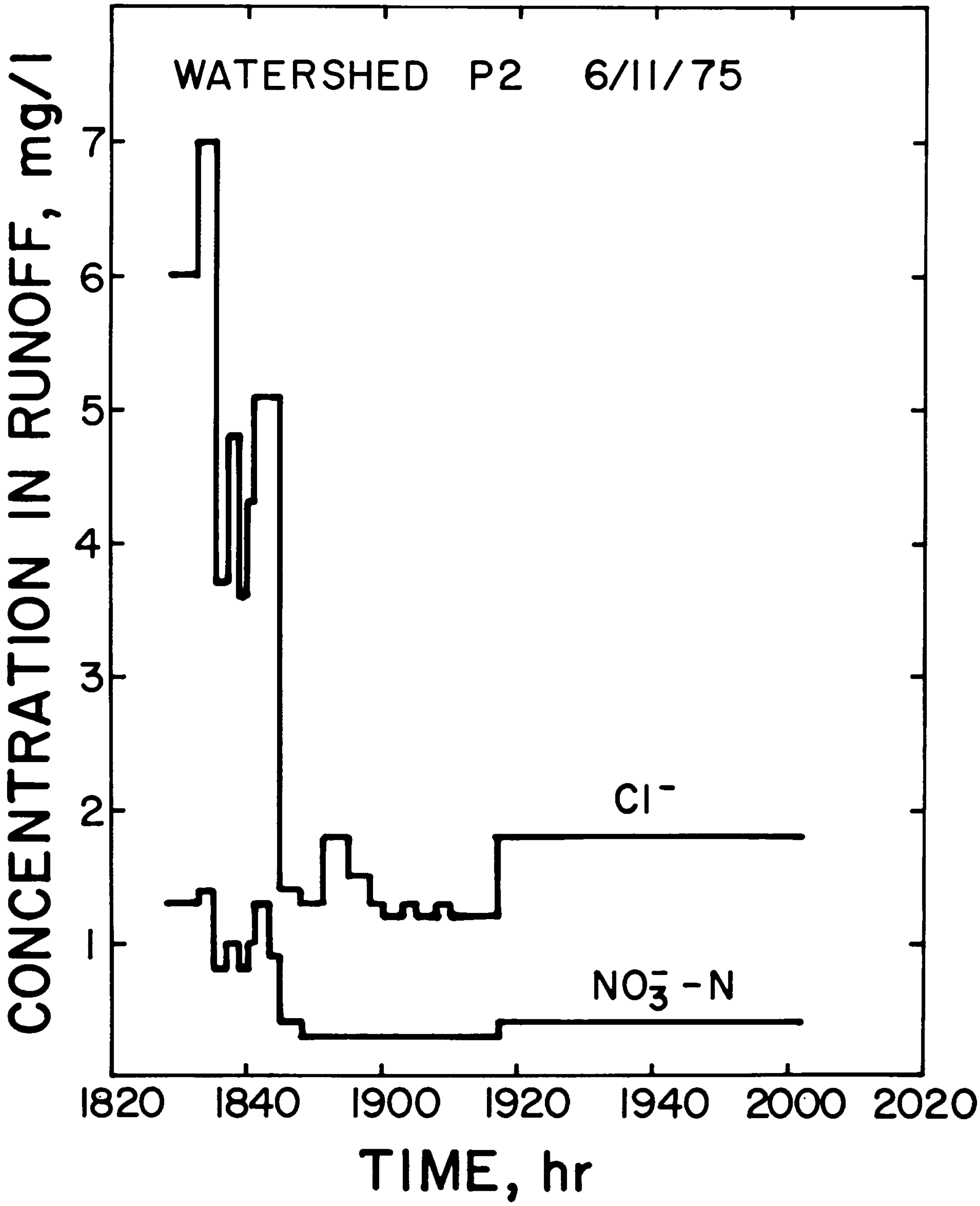


Figure 82. Chloride and nitrate-N concentrations in runoff during a summer runoff event.

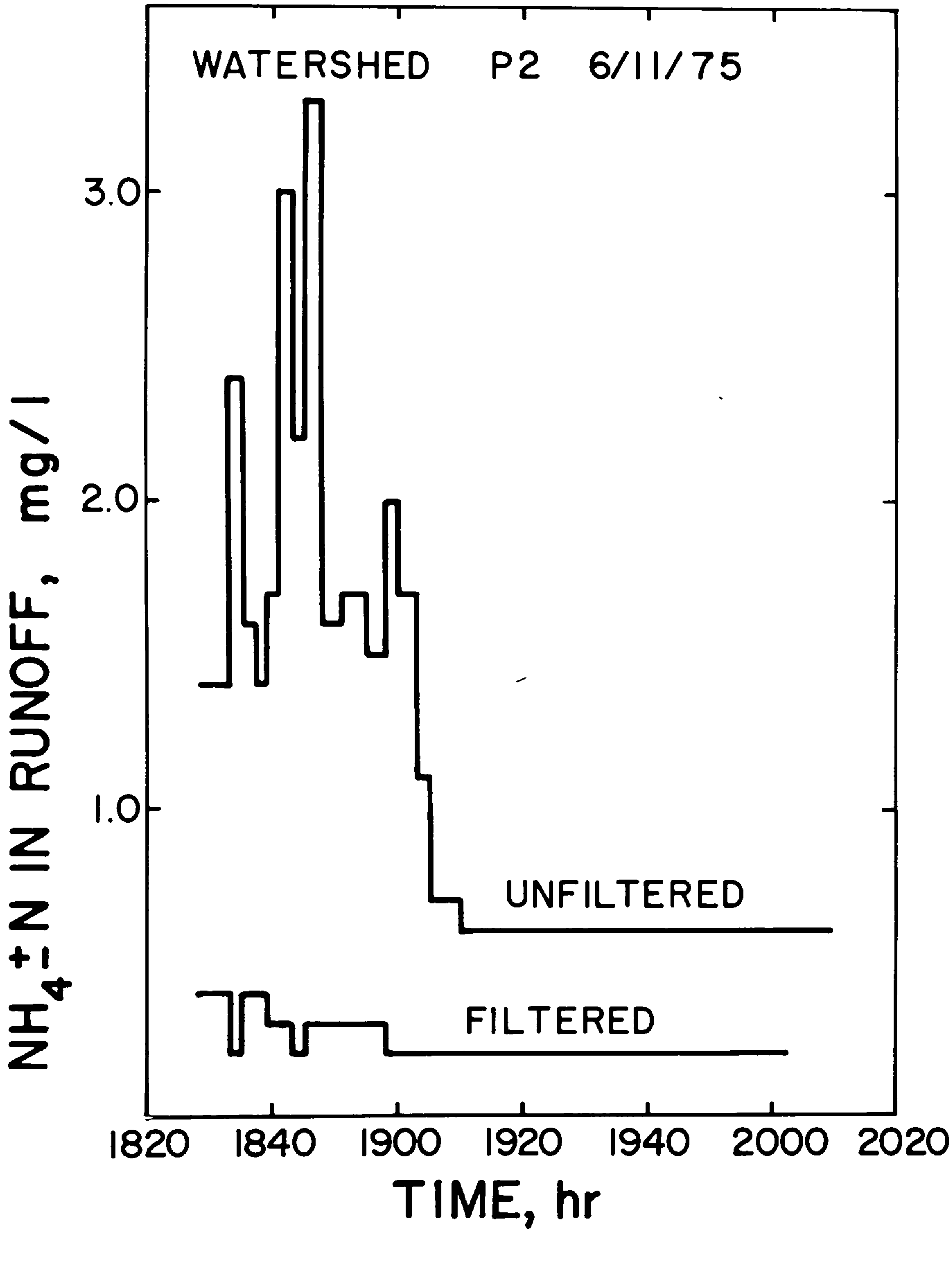


Figure 83. Ammonia-N concentrations in filtered and unfiltered summer storm runoff.

for phosphorus. Soluble molybolate reactive phosphorus (MRP) or ortho-P concentrations were generally low, about 0.1 mg/liter. Total P in filtered samples was only slightly higher in concentration than MRP, indicating that most of the soluble P was in the ortho form (Figure 84). During the study, the range of soluble P was generally in the 0.1 to 0.4 mg/liter range but was not related to sediment concentration.

Because sediment contains organic matter, total Kjeldahl nitrogen (TKN) in unfiltered samples would be expected to relate strongly to suspended sediment. Although a relationship is apparent in Figure 85, it is not as striking as the total P-sediment relationship. Also, a higher proportion of the total-N was water soluble and apparently transported by water. In general, variations in total-N from sample to sample were greater than for other plant nutrient forms.

PLANT NUTRIENT AND CHLORIDE RUNOFF YIELDS

Chloride and plant nutrient runoff yields are presented in Figures 86 through 90. Chlorides and nitrates were measured during three summer and two winter cropping seasons (29 months) (Figure 86). Chloride was the greater contributor to runoff with 10.4 and 13.8 kg/ha for the P4 and P2 watersheds, respectively. An annual average for both watersheds was 5.0 kg/ha; however, precipitation contributed approximately 6.0 kg/ha annually (Figure 91). Although an annual average of 15 percent of the rainfall was surface runoff (Table 13), as much as 60 percent of the runoff occurred during high energy summer storms. Cumulative curves in Figure 86 show that approximately 80 percent of the chloride transported in runoff was caused by seven or eight high energy storms. Therefore, considerable quantities of transported chloride were likely derived from the fertilizer sources.

Precipitation contributed 4.2 kg NO_3-N/ha annually as shown in Figure 91. Data in Figure 86 show that approximately 3.2 kg NO_3-N/ha was transported in runoff during the entire study. Therefore, the percentage of NO_3-N contribution in precipitation was much greater than that of Cl. As with pesticides, a few high energy storms are also responsible for most of the transported NO_3-N. Differences between watersheds are more related to physical features (slope, etc.) and rainfall patterns than to watershed management. In late May 1973, a high energy storm occurred immediately following soil preparation for planting, causing the greatest single loss of both Cl and NO_3-N. Slightly higher final cumulative Cl and NO_3-N yields on the P2 watershed may be attributed to higher runoff volumes. Cumulative yield differences between Cl and NO_3-N reflect plant uptake specificity and biological transformations of fertilizer-N and also application timing. Nitrate-N curves indicate that less than 0.5 kg/ha was lost in runoff annually (including rainfall contributions) following applications of 112 kg N/ha in June to vigorously growing corn. Consequently, proper timing of N-fertilizer applications greatly reduced runoff potential.

Total Kjeldahl nitrogen (TKN), NH_4-N, Total-P, and PO_4-P were measured during two summer and one winter cropping seasons (17 months). Cumulative yield data of these plant nutrients are presented in Figures 87 through 90.

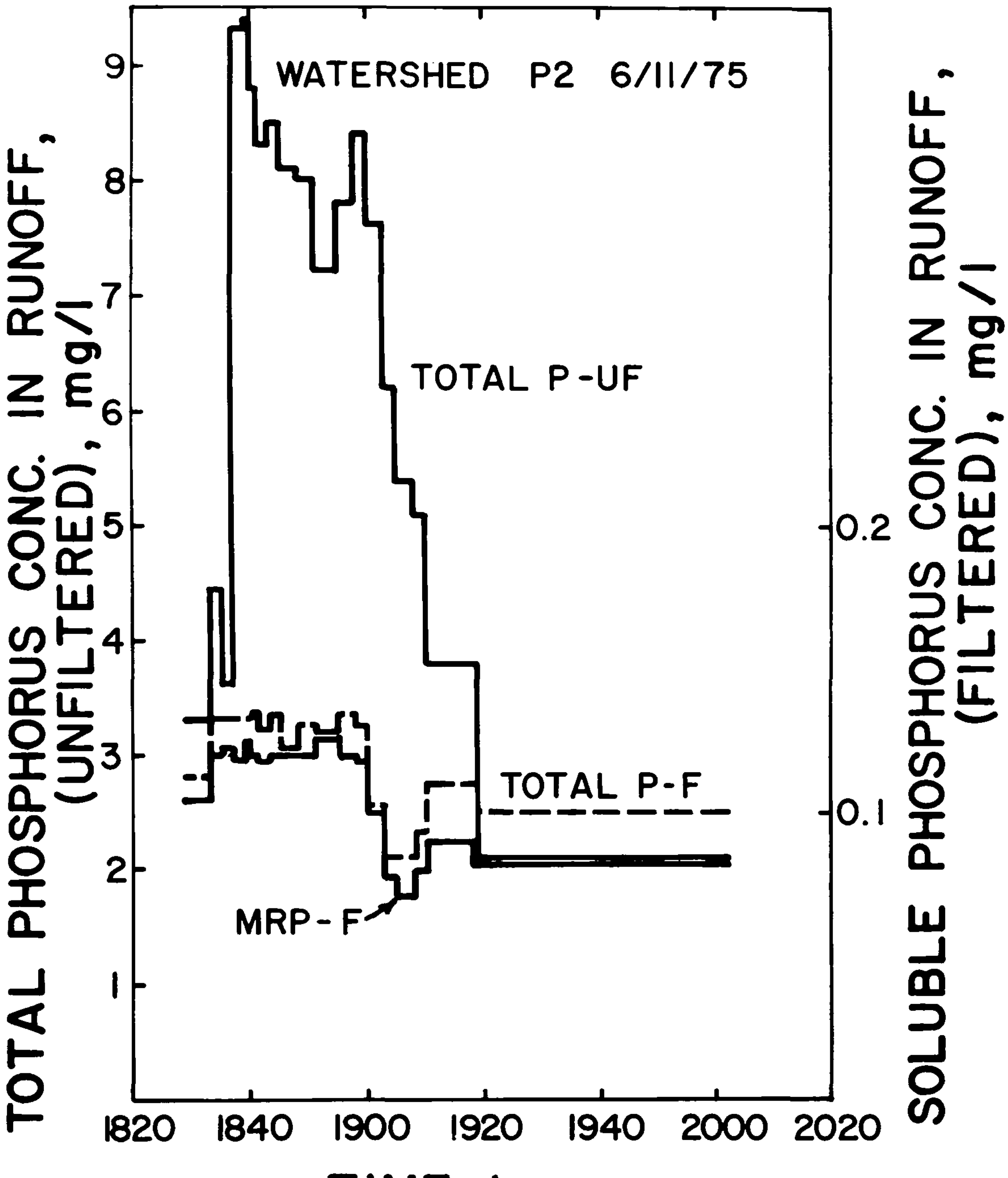


Figure 84. Total phosphorus in filtered (F) and unfiltered (UF) and molybdate reactive phosphorus (MRP or Ortho-P) in summer storm runoff.

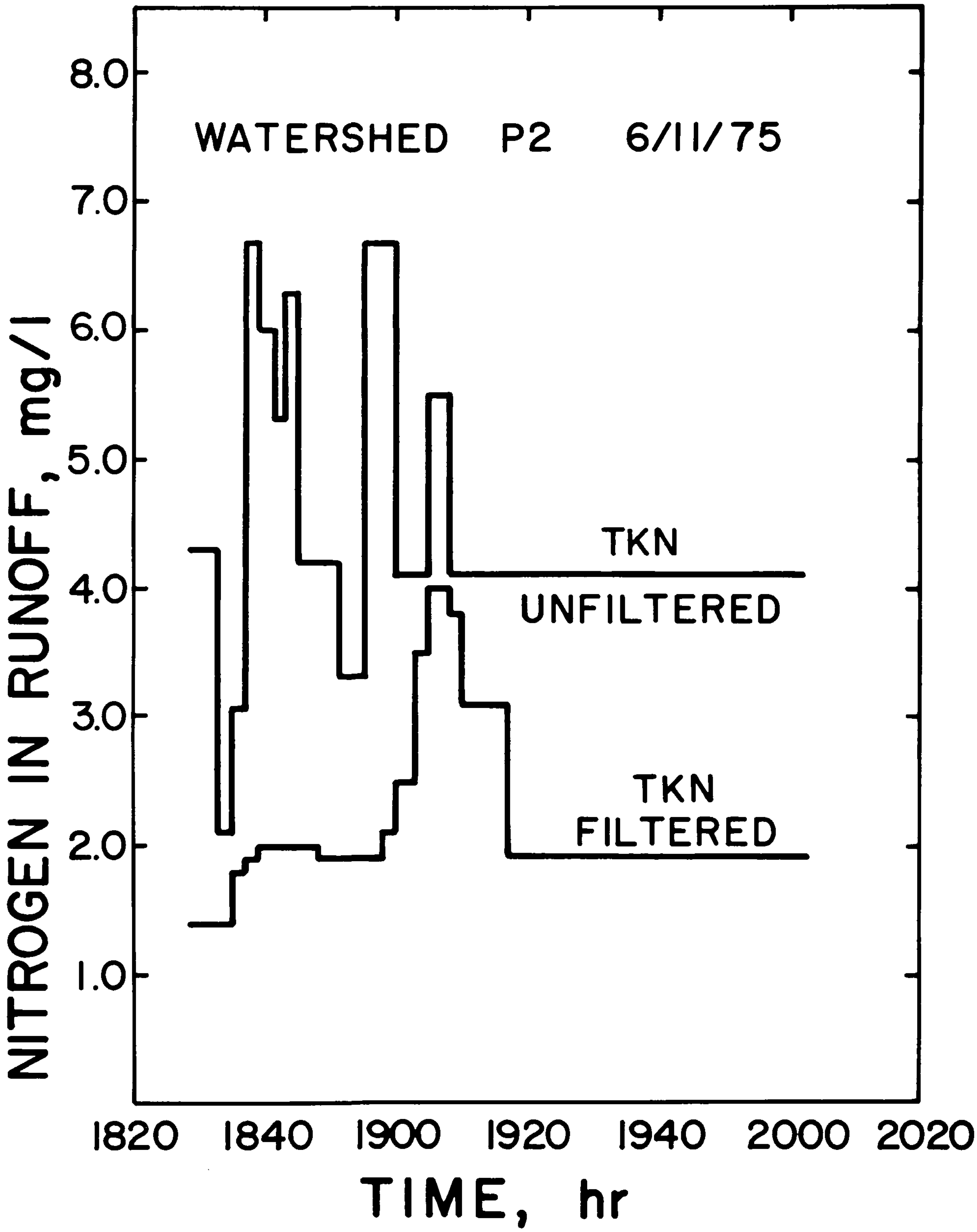


Figure 85. Total Kjeldahl nitrogen (TKN) in filtered and unfiltered summer storm runoff.

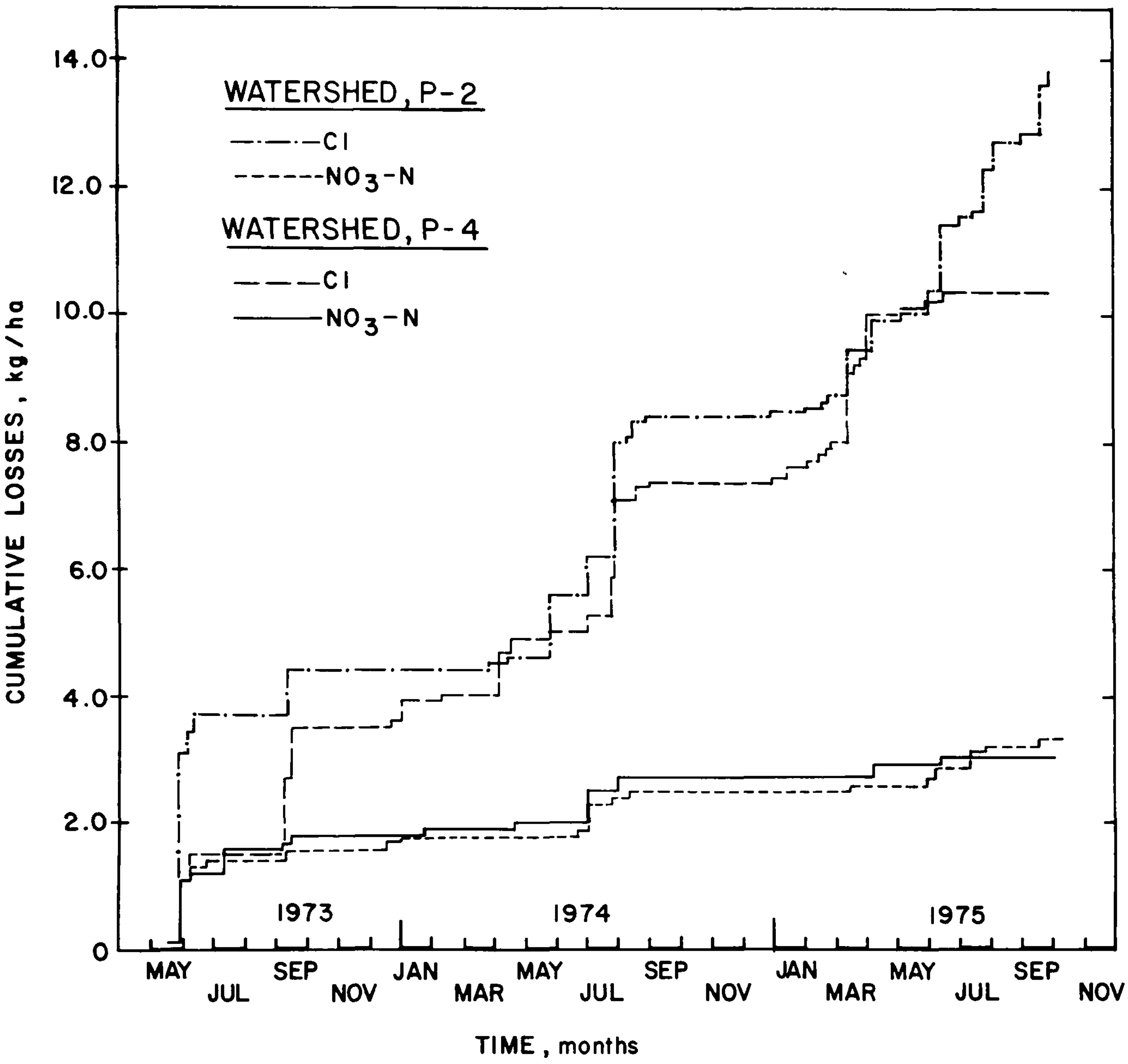


Figure 86. Cumulative chloride and nitrate-N yields in storm runoff.

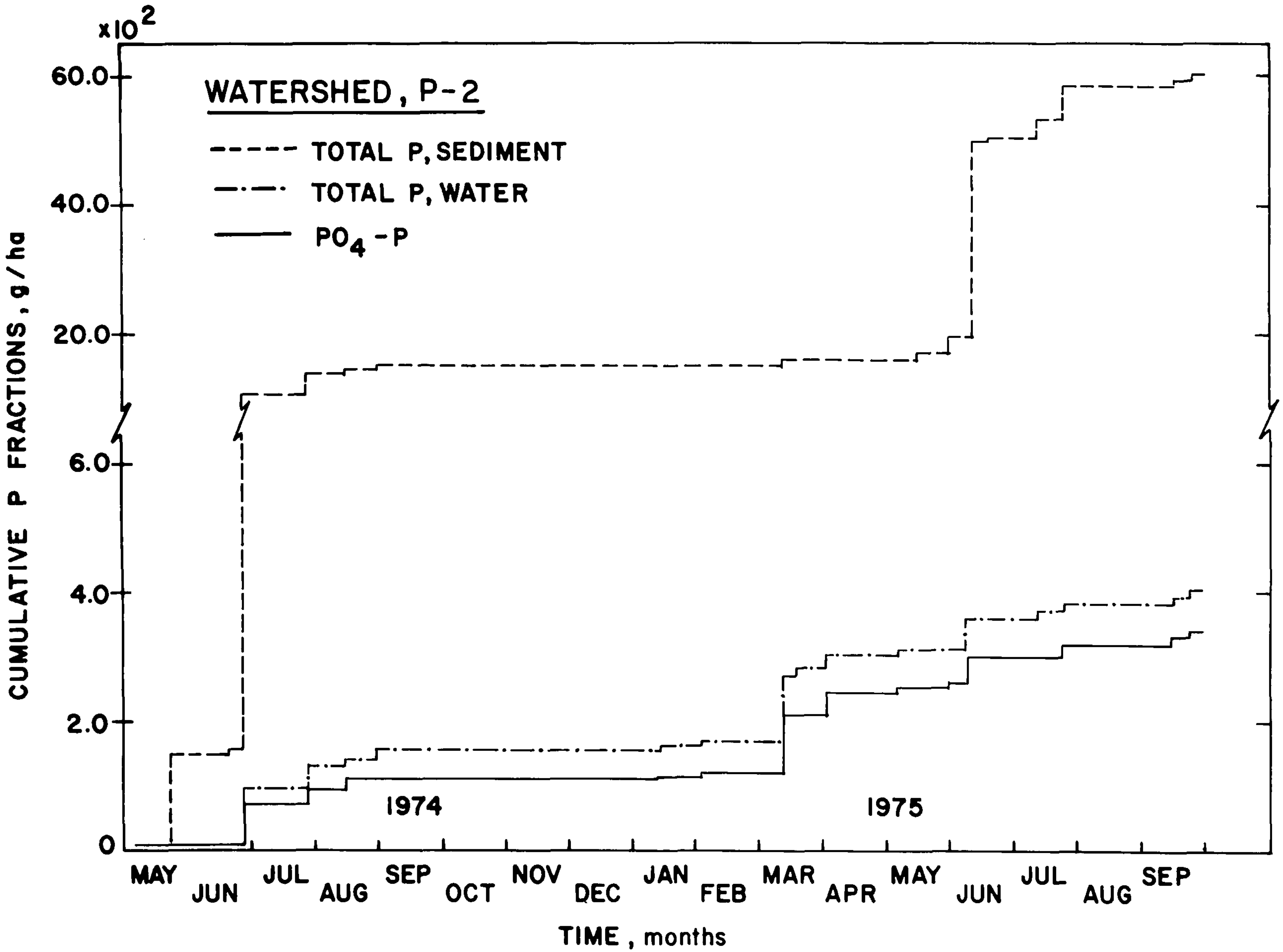


Figure 87. Cumulative phosphorus yields in sediment and water phases of runoff from watershed P2.

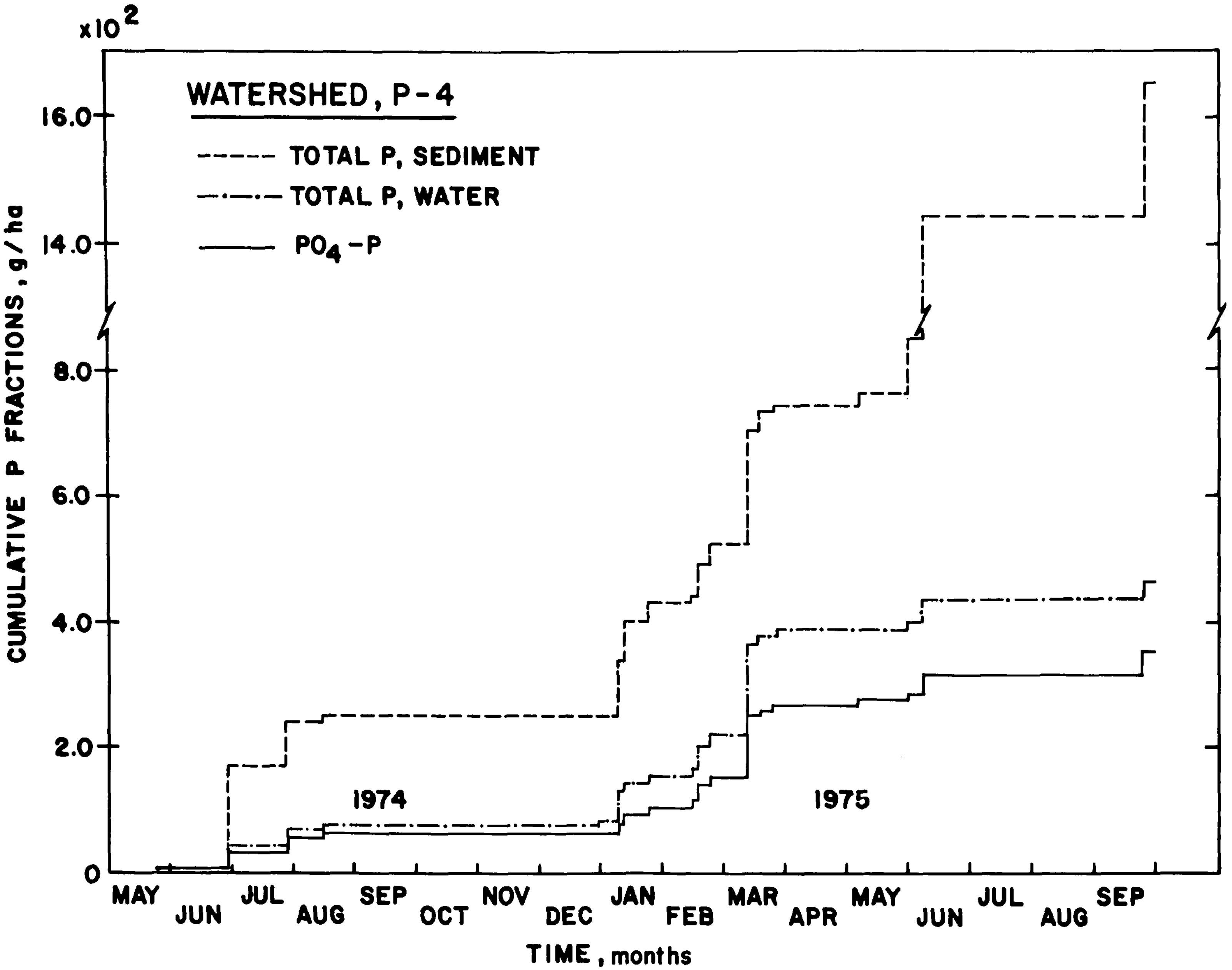


Figure 88. Cumulative phosphorus yields in sediment and water phases of runoff from watershed P4.

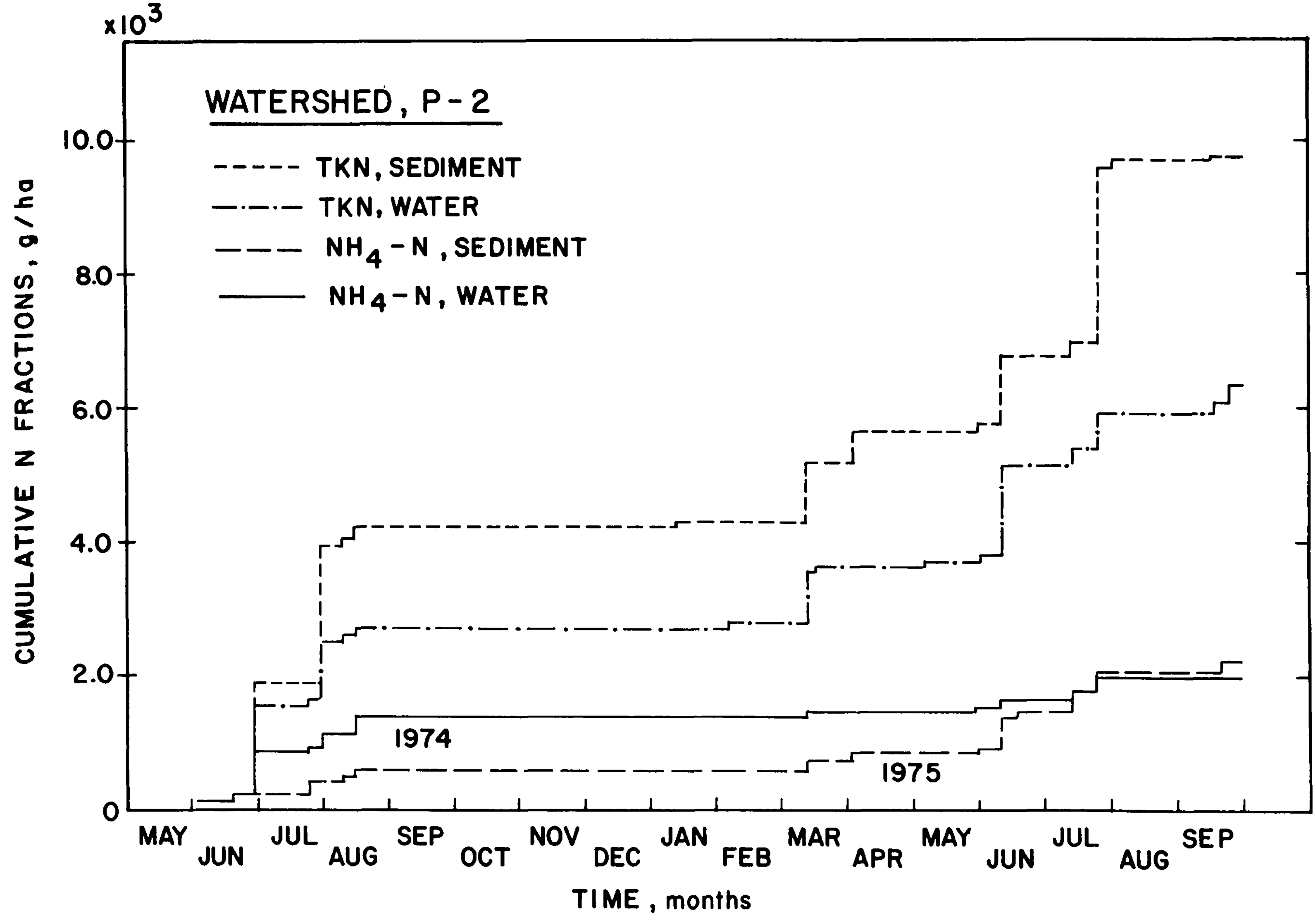


Figure 89. Cumulative nitrogen yields in sediment and water phases of runoff from watershed P2.

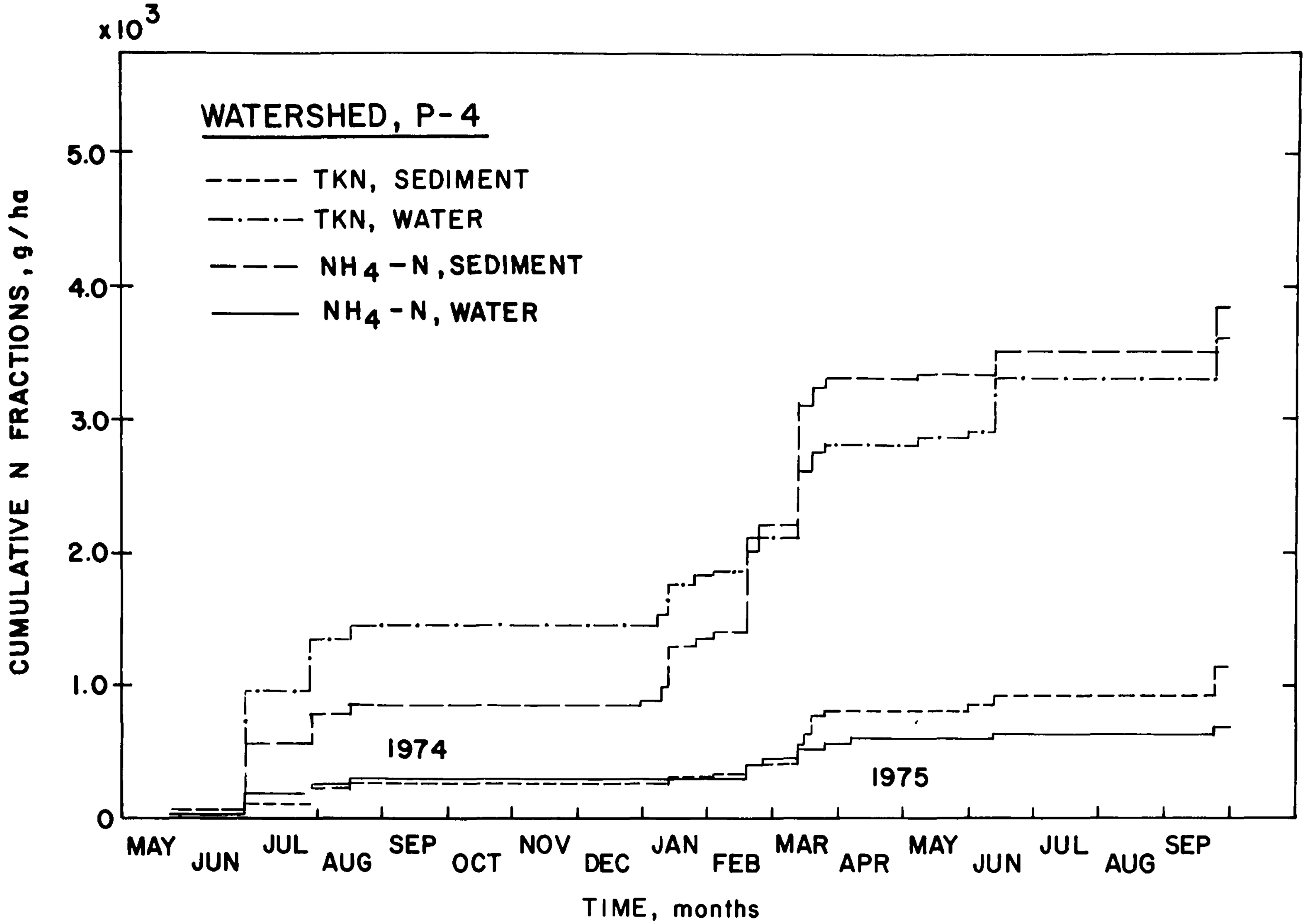


Figure 90. Cumulative nitrogen yields in sediment and water phases of runoff from watershed P4.

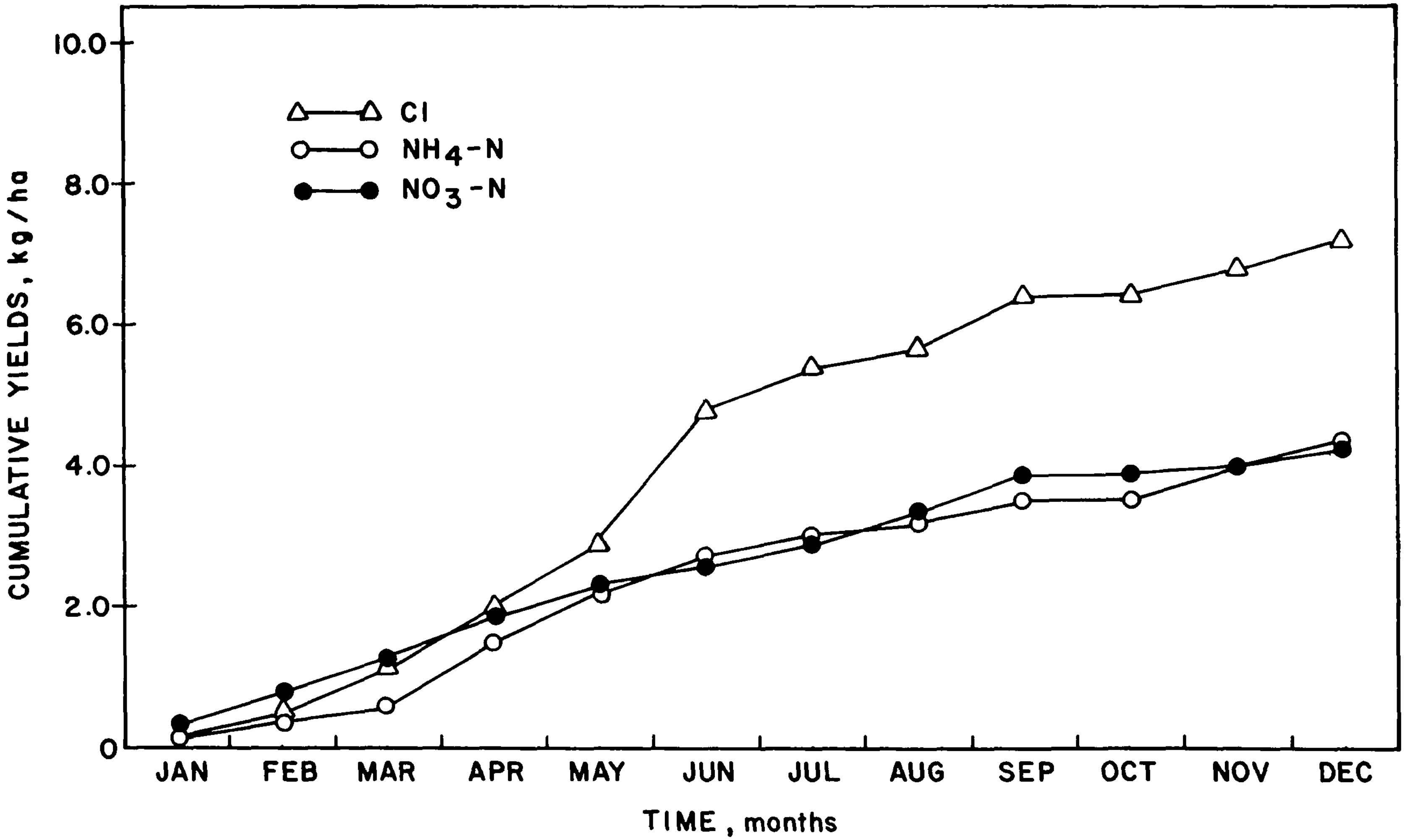


Figure 91. Cumulative chloride, ammonia-N, and nitrate-N yields in precipitation.

Cumulative PO_4-P (designated molybdate reactive phosphorus, MRP) runoff yields were very similar on both watersheds (Figures 87 and 88). These yields related to the cumulative runoff water yield of both watersheds. Water yield from each watershed also did not differ greatly. Cumulative PO_4-P losses were about 380 g/ha, giving an annual average of about 260 g/ha. Approximately 54 percent of the PO_4-P losses measured between May 1974 and May 1975 occurred during January, February, and March 1975. All fertilizers were applied to watersheds during April or May each year. Procedures used to determine PO_4-P were not sufficiently sensitive to estimate PO_4-P contributions from rainfall.

Cumulative runoff yields of NH_4-N are given in Figures 89 and 90. Based on filtered versus unfiltered separation, about the same amount of NH_4-N was in the water phase as was attached to sediment from both watersheds. Total NH_4-N losses from watershed P2 were, however, about twice that from P4. Total losses over the study period were 1.8 and 4.2 kg/ha from P4 and P2, respectively. The larger losses from P2 were associated with higher sediment losses as compared with P4.

Cumulative yields of TKN are also given in Figures 89 and 90. Over the study period, approximately equal amounts of TKN remained in the water phase as compared with the sediment phase (about 3.5 kg/ha) after filtering the runoff from watershed P4. Much of this soluble nitrogen, however, was derived from a single storm occuring in June 1974, shortly after application of a urea-ammonia solution. About twice as much sediment-associated nitrogen (about 10 kg/ha) as compared with solution nitrogen (about 6 kg/ha) was lost from P2. As shown earlier, differences in sediment yield between watersheds P2 and P4 were about the same magnitude. Over the study period, TKN yields from watersheds P2 and P4 were 16 and 7.5 kg/ha, respectively.

Yields of Total-P are also shown in Figures 87 and 88. Values shown for Total-P, water, are values obtained after digesting filtered samples as described in the procedures section. As can be seen, total water P was not greatly higher than PO_4-P (MRP). Occasional storms, however, did yield discernably higher total solution P than was determined as PO_4-P. This may indicate contributions of P from vegatative leaching or decaying crop residues. Total sediment P losses over the study period were 6.0 and 1.7 kg/ha from P2 and P4, respectively, again reflecting differences in yields of sediment mass from the two watersheds. On P2, most of the sediment P was associated with a few storms occurring when the soil was fresh-tilled shortly after planting and fertilizer application.

Yields of plant nutrients and ranges of concentrations found in runoff during the study period are summarized in Table 28.

TRIFLURALIN VOLATILIZATION STUDIES

During conduct of this research project, an opportunity arose for Southern Piedmont Conservation Center personnel, with some assistance from the Athens Environmental Research Laboratory, to superimpose a study of trifluralin vapor flux on watershed P3. Although not a formal part of the overall project described in this report, some of the data obtained have been

TABLE 28. PLANT NUTRIENT YIELDS AND RANGES OF CONCENTRATION IN RUNOFF

Compound	Watershed	Year	Compound loss in runoff, kg/ha/year*			Range of compound loss in runoff increments, ppm	
			Water	Sediment	Total	Water	Sediment
Chloride	P2	1974	5.20		5.20	1-10	-
		1975	2.35	-	2.35	0-13	-
	P4	1974	4.57		4.57	1-35	-
		1975	0.50	-	0.50	0-4	-
PO_4-P	P2	1974	0.25		0.25	0	-
		1975	0.08	-	0.08	0	-
	P4	1974	0.28	-	0.28	0-1	-
		1975	0.07	-	0.07	0	-
NH_4+N	P2	1974	1.48	0.85	2.33	0-4	7-9,000
		1975	0.58	1.39	1.97	0-2	108-5,000
	P4	1974	0.85	1.20	2.05	0-589	94-13,235
		1975	0.08	0.40	0.48	0	124-3,390
NO_3-N	P2	1974	0.86		0.86	0-11	-
		1975	0.67		0.67	0-20	-
	P4	1974	0.92	-	0.92	0-3	-
		1975	0.16	-	0.16	0-1	-
TKN	P2	1974	5.90	5.66	11.56	1-345	83-22,562
		1975	2.14	3.58	5.72	1-5	205-5,607
	P4	1974	2.98	3.25	6.23	1-4	189-6,493
		1975	1.00	0.33	1.33	2-5	146-2,373
Total P	P2	1974	0.54	1.67	2.21	0-371	288-4,937
		1975	0.09	4.09	4.18	0-1	600-21,545
	P4	1974	0.38	0.76	1.14	0-1	139-1,541
		1975	0.08	0.08	0.96	0	1,076-3,586

*The 1975 year values were only during the growing season.

supplied to EPA for use in developing and testing pesticide volatilization models. Data collected included atmospheric concentrations of trifluralin at selected intervals throughout the growing season along with necessary microclimate data for calculation of water and pesticide flux from the treated field by use of both momentum balance and energy balance methods. The dynamics of the soil water regime in the surface 15 cm was also characterized over a 10-day period coinciding with the first phase of the pesticide volatilization study. These data have been published.[5-7]

DATA AVAILABILITY

Detailed data sets for each runoff event and soil core sampling interval (see Appendix D) are stored on magnetic tape and are available upon request.

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Appendix A

Soil:	Starr sandy loam*
Classification:	Fluventic Dystrochrept; fine-loamy, mixed, thermic
Location:	Watkinsville, Georgia, Southern Piedmont Conservation Research Center, Watershed P1

Ap	0-28 cm	Dark brown (7.5YR 4/4) sandy loam; weak fine subangular blocky and granular structure; very friable; few gravel; abrupt wavy boundary.
B1	28-48 cm	Mixed strong brown (7.5YR 5/6) and dark brown (10YR 3/3) sandy clay loam; weak medium subangular blocky structure; friable; few gravel; gradual wavy boundary.
B21	48-71 cm	Yellowish red (5YR 5/6) sandy clay loam; weak medium subangular blocky structure; friable; few yellowish brown splotches; few gravel; gradual smooth boundary.
IIB21t	71-97 cm	Red (2.5YR 4/6) sandy clay; common medium distinct light yellowish brown (10YR 6/4), and brownish yellow (10YR6/6) mottles; moderate medium subangular blocky structure; firm common coarse sand and gravel; few fine mica flakes; continuous, thin clay films on faces of peds; gradual wavy boundary.
IIB23t	97-130 cm	Red (2.5YR 4/8) sandy clay; many coarse distinct brownish yellow (10YR 6/6) mottles; moderate medium subangular blocky structure; firm; few gravel; common fine and medium mica flakes; continuous thin clay films on faces of peds; gradual wavy boundary.
IIB3	130-152 cm	Red (2.5YR 4/6) sandy clay loam; few medium distinct brownish yellow (10YR 6/6) mottles; weak medium subangular blocky structure; friable; common fine mica flakes.

Note: pH not determined in field.

*The pedon described would be a taxajunct or variant to the Starr series in that the solum is 71 centimeters thick over an Appling-like profile; also, the A horizon is slightly thicker than the range in the official description. Described by Glenn L. Bramlett, Soil Correlator, U.S. Soil Conservation Service, Athens, GA.

Figure A1. Soil pedon description.

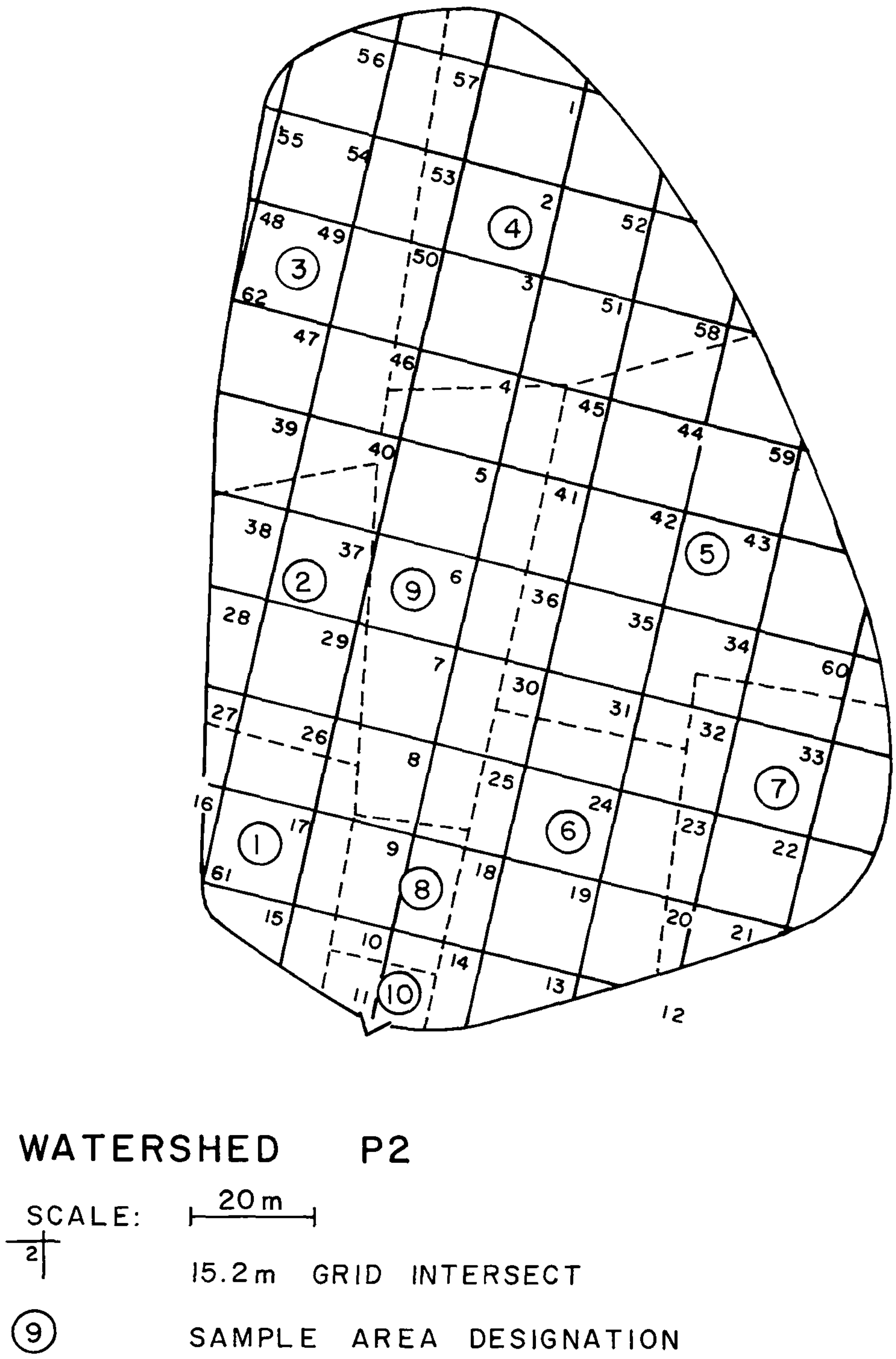


Figure A2. Pesticide and plant nutrient sampling segments and grid arrangement, watershed P2.

Soil:	Cecil sandy loam*
Classification:	Typic hapludult, clayey, kaolinitic, thermic
Location:	Watkinsville, Georgia, Southern Piedmont Conservation Research Center, 10 meters southeast of Watershed P3

Ap	0-20 cm	Light brown (7.5YR 6/4 dry; 5YR 5/4 moist) sandy loam; weak fine granular structure; moderately friable, moist; gradual smooth boundary; many fine roots.
B1	20-30 cm	Light red (2.5YR 6/6 dry) to red (2.5YR 4/6 moist) sandy clay loam; weak medium subangular blocky structure; moderately friable moist; gradual wavy boundary, few coarse sand grains, few medium roots.
B21t	30-64 cm	Red (2.5 5/6 dry; 2.5YR 4/6 moist) clay; moderate medium subangular blocky structure; moderately friable to firm moist; gradual wavy boundary; few coarse sand grains; few medium roots.
B22t	64-102 cm	Red (2.5YR 5/6 dry; 2.5YR 4/6 moist) clay; moderate medium subangular blocky structure; moderately friable moist; gradual wavy boundary; few mica flakes, few quartz gravel.
B3	102-132 cm	Red (2.5YR 5/6 dry; 2.5YR 4/6 moist) clay loam; moderate medium subangular blocky structure; moderately friable moist; common mica flakes; few schist and gneiss fragments.
C	132+ cm	Weathered schist and gneiss material.

*Described by George C. Brock and C. L. McIntyre, U.S. Soil Conservation Service, Athens, GA.

Figure A3. Soil pedon description.

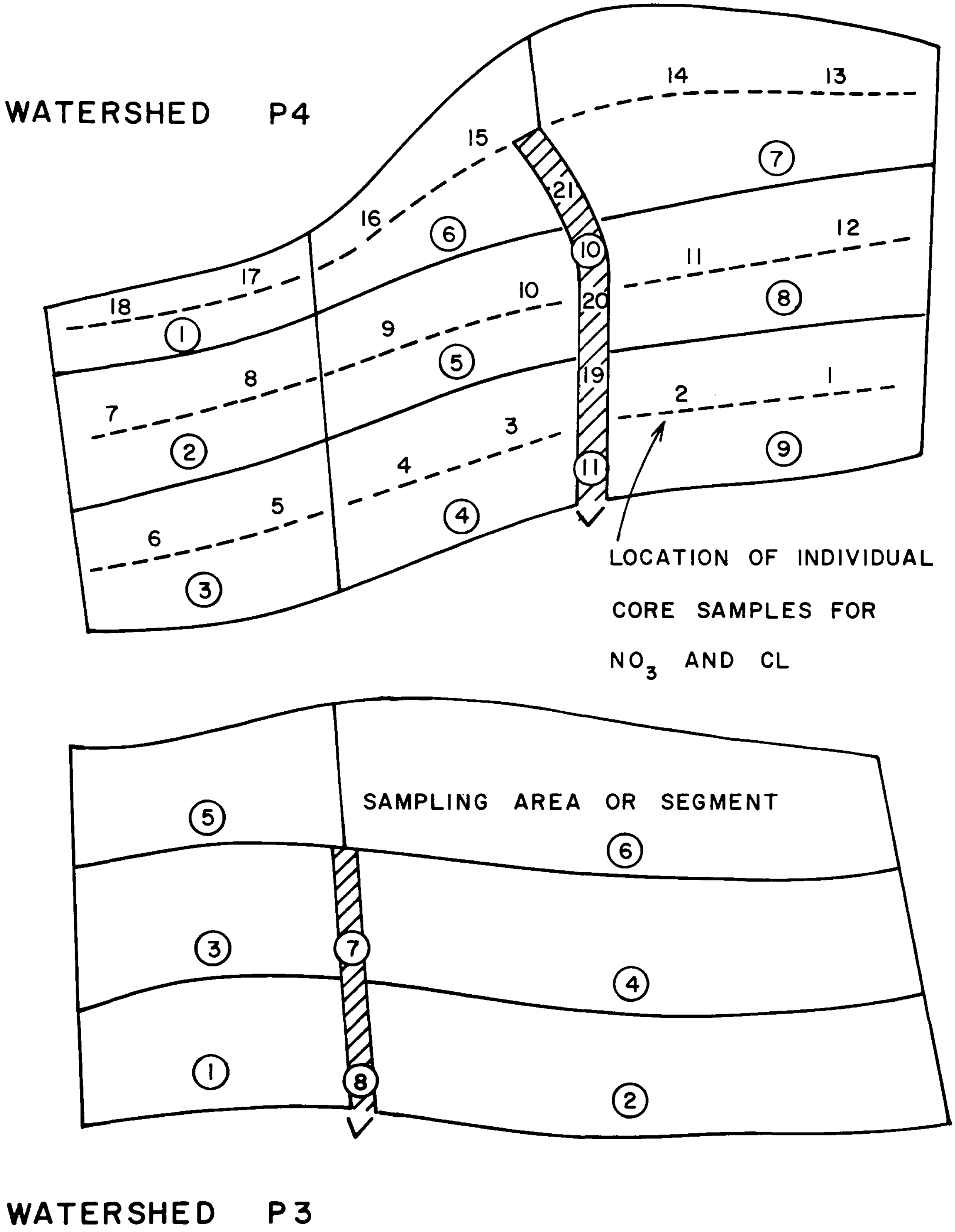


Figure A4. Sampling segments and locations, watersheds P3 and P4.

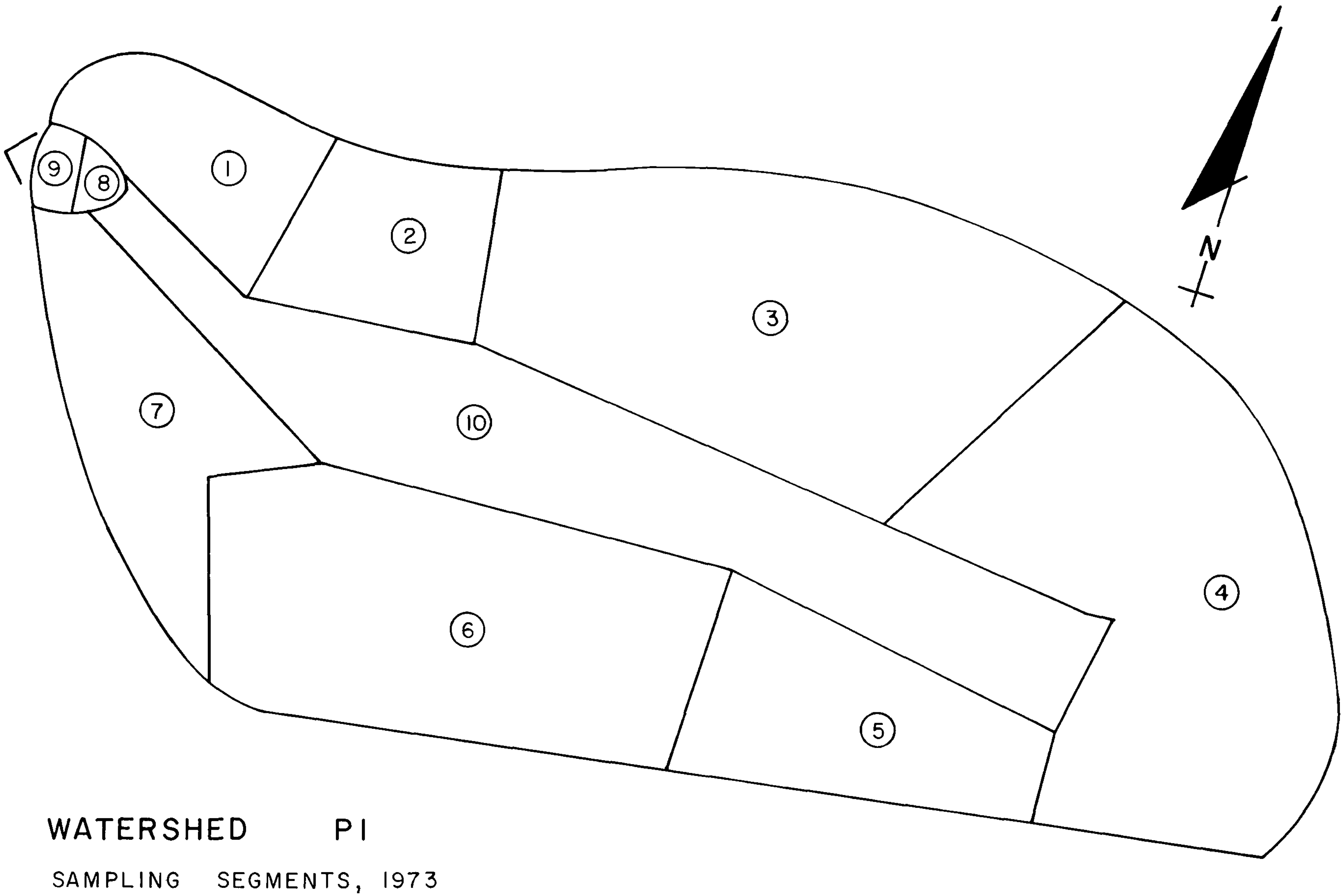


Figure A5. Sampling segments and locations, watershed P1, 1973.

TABLE A1. SOIL CHARACTERISTICS, WATERSHED P1, 0-15 cm

Watershed segment*	Percent sand	Percent silt	Percent clay	Specific surface, m^2/g	Percent carbon	pH
1	70	20	10	3.6	0.46	6.1
2	72	20	9	4.9	0.49	6.3
3	66	20	13	7.4	0.59	6.3
4	66	22	12	6.7	0.58	6.2
5	71	18	11	5.3	0.40	6.6
6	68	20	12	6.7	0.71	6.3
7	61	25	14	5.8	0.64	6.3
Average, $\bar{x}$†	66	20	12	6.2	0.57	6.0

*Initially P1 was sampled as 7 segments instead of 10 as shown in Figure A5. Segments 8-10 were included in other segments, the central drainage channel being the line of separation between segments.

†Weighted average, weighing values for each segment in proportion to segment area.

TABLE A2. SOIL CHARACTERISTICS, WATERSHED P2, 0-152 cm*

Watershed segment	Depth, cm	Percent sand	Percent silt	Percent clay	pH	Specific surface, m^2/gm	Percent nitrogen	Percent carbon	Total P, ppm	Extractable P, ppm
1	0-15	59	19	22	5.7	8.4	0.024	0.69	175	14
	15-30	50	13	37			0.006			
	30-46	36	11	53			0.009			
	46-61	39	16	45			0.008			
	61-91	46	18	37			0.007			
	91-122	45	24	31			0.007			
	122-152	46	20	34			0.008			
2	0-15	68	17	16	6.2	4.5	0.016	0.62	190	38
	15-30	60	16	23			0.007			
	30-46	43	13	45			0.008			
	46-61	33	10	57			0.007			
	61-91	34	15	51			0.007			
	91-122	45	28	27			0.007			
	122-152	52	29	20			0.006			
3	0-15	69	17	15	6.0	6.6	0.043	0.60	157	19
	15-30	54	19	28			0.028			
	30-46	33	16	51			0.008			
	46-61	36	19	45			0.008			
	61-91	46	21	33			0.007			
	91-122	60	22	18			0.007			
	122-152	56	27	17			0.007			
4	0-15	76	15	9	5.7	5.0	0.023	0.52	187	60
	15-30	61	19	20			0.013			
	30-46						0.008			
	46-61						0.007			
	61-91						0.006			
	91-122						0.006			
	122-152						0.006			
5	0-15	69	23	7	5.8	4.3	0.033	0.79	142	29
	15-30	64	23	13			0.015			
	30-46	55	22	23			0.008			
	46-61	41	18	41			0.007			
	61-91	38	19	43			0.006			
	91-122	43	28	29			0.007			
	122-152	43	31	25			0.006			
6	0-15	74	16	18	5.9	4.7	0.006	0.59	161	20
	15-30	59	16	25			0.008			
	30-46	39	14	46			0.007			
	46-61	38	14	48			0.006			
	61-91	41	14	45			0.007			
	91-122	45	18	37			0.007			
	122-152	51	25	25			0.006			
7	0-15	63	20	18	5.7	9.2	0.015	0.57	189	29
	15-30	50	15	35			0.009			
	30-46	36	12	53			0.008			
	46-61	37	15	49			0.009			
	61-91	41	20	38			0.006			
	91-122	47	25	28			0.006			
	122-152	59	23	18			0.008			
8	0-15	70	21	9	5.4	5.3	0.072	0.93	210	22
	15-30	66	24	10			0.031			
	30-46	53	28	19			0.017			
	46-61	55	17	28			0.007			
	61-91	58	12	30			0.006			
	91-122	66	7	27			0.006			
	122-152	73	4	23			0.007			

TABLE A2 (continued). SOIL CHARACTERISTICS, WATERSHED P2, 0-152 cm*

Watershed segment	Depth, cm	Percent sand	Percent silt	Percent clay	pH	Specific surface, m^2/gm	Percent nitrogen	Percent carbon	Total P, ppm	Extractable P, ppm
9	0-15	42	41	18	5.6	8.3	0.083	1.59	216	30
	15-30	55	33	12			0.059			
	30-46	59	24	17			0.009			
	46-61	70	8	22			0.007			
	61-91	60	11	29			0.006			
	91-122	47	5	48			0.007			
	122-152	57	11	33			0.006			
10	0-15	73	23	5	5.8	3.3		0.66	184	45
	15-30	70	21	9						
	30-46	79	10	11						
	46-61	70	11	20						
	61-91	67	1	32						
	91-122	55	5	40						
	122-152	52	13	35						
Average†	0-15	66	21	13	5.8	6.0	0.035	0.75	182	31
	15-30	59	20	21			0.020			
	30-46	48	17	35			0.009			
	46-61	46	15	39			0.007			
	61-91	47	15	37			0.006			
	91-122	51	19	31			0.007			
	122-152	55	20	25			0.007			

*Total N and extractable P determined on core samples removed 06-06-74; all other determinations on composite samples from each watershed segment taken before initiation of experiments, spring 1973.

†Weighted average, weighting values of each segment in proportion to percent of total watershed area.

TABLE A3. SOIL CHARACTERISTICS, WATERSHED P3, 0-15 cm

Watershed segment	Percent sand	Percent silt	Percent clay	Specific surface, m^2/g	Percent carbon	pH
1	64	19	17	6.9	0.44	6.6
2	64	18	17	9.7	0.70	6.5
3	65	16	19	8.3	0.35	6.7
4	63	19	17	9.4	0.59	6.5
5	63	23	14	9.5	0.53	6.5
6	68	18	14	9.0	0.55	6.6
7	58	25	17	10.2	0.66	6.2
Average, $\bar{x}$*	64	19	17	8.9	0.55	6.7

*Weighted average, weighting values of each segment in proportion to percent of total watershed area.

TABLE A4. SOIL CHARACTERISTICS, WATERSHED P4, 0-152 cm*

Watershed segment	Depth, cm	Percent sand	Percent silt	Percent clay	pH	Specific surface, m^2/gm	Percent nitrogen	Percent carbon	Total P, ppm	Extractable P, ppm
1	0-15	52	24	24	6.0	12.8	-	0.79	134	
	15-30	49	7	44						
	30-61	40	17	43						
	61-91	55	16	29						
	91-122	46	18	36						
	122-152	56	16	28						
2	0-15	62	27	11	6.0	6.0		0.73	175	-
	15-30	47	28	24						
	30-61	39	21	40						
	61-91	38	20	43						
	91-122	37	23	40						
	122-152	40	20	40						
3	0-15	61	24	16	6.0	6.7		0.57	142	-
	15-30	49	18	33						
	30-61	42	13	45						
	61-91	42	15	43						
	91-122	41	21	38						
	122-152	47	23	30						
4	0-15	73	19	8	6.1	3.7	-	0.52	170	-
	15-30	61	26	12						
	30-61	42	20	37						
	61-91	34	14	51						
	91-122	35	19	46						
	122-152	45	17	37						
5	0-15	57	24	19	5.7	10.4		0.46	176	-
	15-30	60	22	18						
	30-61	40	17	43						
	61-91	46	18	36						
	91-122	54	21	25						
	122-152	48	27	25						
6	0-15	59	23	17	6.3	9.1	-	0.77	199	
	15-30	41	22	37						
	30-61	35	24	41						
	61-91	45	16	38						
	91-122	56	18	26						
	122-152	56	21	23						
7	0-15	50	30	20	6.1	10.2		0.76	143	-
	15-30	44	19	37						
	30-61	39	14	46						
	61-91	47	15	38						
	91-122	63	17	20						
	122-152	84	13	4						
8	0-15	66	22	12	5.9	5.5	-	0.65	160	
	15-30	49	14	37						
	30-61	48	12	39						
	61-91	40	11	49						
	91-122	57	15	28						
	122-152	40	22	38						
9	0-15	62	25	12	6.5	7.1	-	0.98	167	
	15-30	56	15	29						
	30-61	36	10	54						
	61-91	46	11	43						
	91-122	54	12	34						
	122-152	59	31	10						

TABLE A4 (continued). SOIL CHARACTERISTICS, WATERSHED P4, 1-152 cm*

Watershed segment	Depth, cm	Percent sand	Percent silt	Percent clay	pH	Specific surface, m^2/gm	Percent nitrogen	Percent carbon	Total P, ppm	Extractable P, ppm
Average†	0-15	60	24	15	6.1	7.9	0.048‡	0.69	163	23‡
	15-30	51	19	30			0.019			
	30-61	40	16	43			0.009			
	61-91	44	15	38			0.009			
	91-122	49	18	33			0.006			
	122-152	53	21	26			0.006			

*Total N and extractable P determined on core samples removed 06-06-74; all other determinations on composite samples from each watershed segment taken before initiation of experiments, spring 1973.

†Weighted average, weighting values of each segment in proportion to percent of total watershed area.

‡Insufficient core samples to characterize each segment independently.

TABLE A5. SAMPLING SEGMENT AREAS

Sampling segment number	Watershed P1*	P2	P3	P4
	-------Segment size, ha-------			
1	0.169	0.085	0.141	0.065
2	0.173	0.109	0.287	0.125
3	0.594	0.202	0.141	0.137
4	0.514	0.190	0.287	0.141
5	0.200	0.206	0.127	0.142
6	0.428	0.158	0.261	0.129
7	0.220	0.134	0.0113	0.271
8	0.016	0.038	0.0023	0.174
9	0.023	0.162	-	0.190
10	0.364	0.008	-	0.028
11				0.003
Watershed size, ha	2.701	1.292	1.258	1.405

*During 1974 and 1975, areas 8 and 10 were combined and designated as area 8.

Appendix B

SCHEDULING OF FIELD OPERATIONS

P1 WATERSHED

<u>1972 Cropping Season</u>

05-18-72 Watershed tilled 20 centimeters deep with a moldboard plow.

06-16-72 Fertilizer applied at rates of 5-15-56 kilograms per hectare of N (ammonium nitrate), P (superphosphate), and K (muriate of potash), respectively, and incorporated with disk harrow.

07-01-72 Planting day.

Trifluralin application started at 0930 hours. The incorporation and planting followed.

Coker 318 soybeans were planted in rows spaced 90 centimeters apart.

The spraying of surface applied chemicals (paraquat and diphenamid completed by 1200 hours.

<u>Application rate of applied chemicals</u>:

	Desired rate, kg/ha
Trifluralin (PPI)*	1.12
Diphenamid (Enide) (PE)	3.36
Paraquat and Surfactant X77, 0.6 ml/L (PE) (calculated as dichloride salt)	15.34

12-03-72 Harvested soybeans. Yield of 1080 kilograms per hectare (16.0 bushels per acre).

General Comments: Poor crop production caused by late planting and water stress. Less than 50 percent crop cover at the maximum vegetative stage.

*PPI = Pre-plant incorporation
PE = Pre-emergence

1973 Cropping Season

05-22-73 Prior to this date, the watershed was covered with soybean stubble and residue. Fertilizer was applied at the rate of 21-19-53 kilograms per hectare of N (ammonium nitrate), P (superphosphate), and K (muriate of potash), respectively, and incorporated with disk harrow.

06-04-73 A high intensity rainfall occurred on 05-28-73, causing severe soil erosion. Fertilizer was reapplied at the rate of 25-22-62 kilograms per hectare of N (ammonium nitrate), P (superphosphate), and K (muriate of potash), respectively.

06-05-73 Rows were marked by light cultivation with rolling cultivator as a guide for herbicide (trifluralin) application prior to planting.

06-06-73 Another high intensity rainfall occurred that caused severe soil erosion and made the watershed unsuitable for planting.

06-12-73 Watershed redisced for planting and rows marked with rolling cultivator as before.

06-13-73 Planting day.

Background pesticide samples were taken in the early morning and were dated 06-12-73 to avoid confusion with post-plant samples. Trifluralin application began at 0800 hours. The incorporation/planting operation and application of surface applied compounds (paraquat and diphenamid) completed at 1345 hours. Bragg soybeans were planted in rows 90 centimeters apart.

Application rate of applied chemicals:

	Desired rate, kg/ha
Trifluralin (PPI)	1.12
Diphenamid (Enide) (PE)	3.36
Paraquat and Surfactant X77, 0.6 ml/L (PE) (calculated as dichloride salt)	1.53

Immediately following pesticide application, post-plant pesticide soil core samples were obtained. A very large rainfall occurred, causing a gully to form in sampling area number 8. Many of the soybean seeds were eroded and deposited in the flume approach area.

11-19-73 Soybean harvested with a yield of 1030 kilograms per hectare (15.3 bushels per acre). Low yield was caused by the large washed-out area within the shed. No cultivation or planting of winter crop.

1974 Cropping Season

05-22-74 Fertilizer applied at the rate of 17-15-41 kilograms per hectare of N (ammonium nitrate), P (superphosphate), and N (muriate of potash), respectively, and incorporated.

05-25-74 Background pesticide samples were obtained (seven increments to 30 centimeters).

05-28-74 A rolling cultivator was used to prepare soil for planting and to guide the pesticide applicator for trifluralin application.

05-30-74 Planting day.

Trifluralin application, incorporation, and planting began at 1400 hours. Application of surface applied pesticides completed by 1600 hours. Essex soybeans were planted in rows spaced 90 centimeters apart.

Application rate of applied chemicals:

	Desired rate, kg/ha
Trifluralin (PPI)	1.12
Diphenamid (Enide) (PE)	3.36
Paraquat and Surfactant X77, 0.6 ml/L (PE) (calculated as dichloride salt)	1.53

Filter discs were used to monitor the pesticide application rate. A 0- to 1-centimeter soil sample was taken with spatula for pesticide analysis.

07-30-74 Applied 0.56 kilograms per hectare of 2,4-DB (Butoxone) in an attempt to control Jimson weeds.

10-18-74 Soybeans harvested. Yield was 1570 kilograms per hectare (23.3 bushels per acre).

10-22-74 Barley (Barsoy variety) was planted at a seeding rate of 108 kilograms per hectare. A grain drill was used to no-till plant barley.

10-30-74 A grass waterway area was installed and the alluvial material in the flume approach area removed.

11-04-74 Waterway and flume approach area seeded with fescue grass.

1975 Cropping Season

02-01-75 Fertilized barley with 73-22-62 kilograms per hectare of N (ammonium nitrate), P (superphosphate), and K (muriate of potash), respectively.

05-23-75 Harvested barley. Yield of 2800 kilograms per hectare (52.0 bushels per acre). Amount of barley residue (mulch) estimated at 7388 kilograms per hectare.

05-29-75 Pesticide background (soil core) samples were taken from all areas except P1-8 (grass waterway) and P1-9 (flume approach). These areas were very hard and dry.

06-02-75 Planting day.

Dekalb BR-54 variety grain sorghym was planted with no-till planter system. Planting was completed by 1000 hours. 215,186 plants per hectare (87,120 plants per acre).

Pesticides applied between 1430 and 1530 hours.

Application rate of applied chemicals:

	Desired rate, kg/ha
Paraquat and Surfactant X77, 0.6 ml/L (PE) (calculated as dichloride salt)	1.53
Propazine (Milogard 80W), (PE)	2.80

The pesticide application was monitored by timing technique and filter discs.

07-07-75 A directed nitrogen solution was applied to grain sorghum at a rate of 90 kilograms per hectare mixed with 0.56 kilograms per hectare of 2,4-D (Dow Formula 40).

10-24-75 Harvested grain sorghum. Yield of 7526 kilograms per hectare (112 bushels per acre) with an average stover of 9000 kilograms per hectare.

10-29-75 No-till planted Keowee variety barley with grain drill.

P2 WATERSHED

1973 Cropping Season

04-18-73 Watershed was tilled 20 centimeters deep with a moldboard plow.

05-03-73 Soil samples for nutrient background (eight increments to 152 centimeters).

05-05-73 Pesticide background soil cores were taken (seven increments to 30 centimeters).

05-11-73 Planting day.

A specially blended fertilizer (6-6-24) was applied at rates of 28-17-127 kilograms per hectare of N (inorganic derived from 3.68 percent ammonium sulfate and 2.35 percent diammonium phosphate), 2.6 percent P (derived from diammonium phosphate), and 19.9 percent K (derived from muriate of potash), respectively. Incorporation of fertilizer and planting began at 1100 hours. Pioneer 3009 (yellow variety corn was planted approximately 15 centimeters apart in rows spaced 90 centimeters apart.

Application rate of applied chemicals:

	Desired rate, kg/ha
Atrazine (80W) (PE)	3.36
Paraquat and Surfactant X77, 0.6 ml/L (PE) (calculated as dichloride salt)	1.53

Soil samples of 0 to 1 centimeter were taken immediately following application for pesticide analysis. Soil samples at depth of 0 to 7.5 and 7.5 to 15 centimeters were taken for chloride analysis. About 1900 hours, a windstorm disturbed the dry surface soil.

05-14-73 Samples of the 0- to 1-centimeter zone were again taken because of the windstorm that occurred on planting day.

06-23-73 A solution of 2,4-D (Dow Formula 40) and nitrogen (50 percent urea and 50 percent ammonia) was applied at the rate of 0.56 kilograms per hectare and 112 kilograms per hectare, respectively. The 2,4-D was used to control morning glory and cocklebur.

10-29-73 Corn yield samples were taken. Results were 2234 kilograms per hectare (35.5 bushels per acre) of corn and 3100 kilograms per hectare of stover.

11-02-73 Corn harvested. Plant density of 50,000 plants per hectare.

11-02-73 Post-harvest nutrient samples (eight increments to 152 centimeters).

11-05-73 Corn stalks cut with rotary mower.

1974 Cropping Season

04-19-74 Pesticide background samples were taken (seven increment to 30 centimeters).

04-22-74 Background nutrient samples were taken (eight increments to 152 centimeters).

04-23-74 Watershed disced.

04-25-74 Watershed tilled (20 centimeters deep) with a chisel-type implement.

04-29-74 Planting day.

A specially blended fertilizer (6-12-24) was applied at rates of 38-33-127 kilograms per hectare of N (inorganic derived from 1.32 percent ammonium sulfate and 4.69 percent diammonium phosphate), 5.24 percent P (derived from diammonium phosphate), and 19.9 percent K (derived from muriate of potash), respectively, and incorporated. Incorporation of fertilizer and planting began at 1100 hours. Pioneer 3009 (yellow) variety corn planted in rows spaced 90 centimeters apart.

Application rate of applied chemicals:

	Desired rate, kg/ha
Atrazine (80W) (PE)	3.36
Paraquat and Surfactant X77, 0.6 ml/L (PE) (calculated as dichloride salt)	1.53

Chemical application started at 1400 hours. Filter discs were used to monitor pesticide application. A 0- to 1-centimeter composite spatula sample was taken of the entire shed for pesticide analysis. Soil core samples were taken by "split tube" method for nutrient analysis at depths of 0 to 7.5 and 7.5 to 15 centimeters. Samples were taken from the designated pesticide sampling areas.

05-02-74 Nutrient samples were taken by "split tube" method from P2-9 which was divided into areas P2-9A and P2-9B.

05-08-74 Nutrient samples were taken by "split tube" method from the designated pesticide sampling areas.

05-09-74 Nutrient samples were taken by "split tube" method from the areas designated P2-3 and P2-9A.

05-14-74 Nutrient samples were taken by "split tube" method from areas P2-1, P2-2, P2-3, P2-4, P2-9A, and P2-10. The remaining sampling areas were not sampled because of soil dryness and excessive resistance to penetration.

05-20-74 Nutrient samples were taken with hydraulic sampler from each sampling area (eight increments to 152 centimeters). The corn was about 20 centimeters tall.

06-11-74 A solution of 2,4-D (Dow Formula 40) and nitrogen (50 percent urea and 50 percent ammonia) was applied at a rate of 0.56 kilograms per hectare of 2,4-D and 100.67 kilograms of nitrogen. Nitrogen was determined by nozzle delivery rate and total time application was on watershed. Desired rates were 112 kilograms per hectare of nitrogen (between 1200 and 1300 hours).

07-08-74 Nutrient samples were taken manually with bucket auger from each sample area (eight increments to 152 centimeters). Started sampling on 07-02-74 and finished on 07-10-74. All samples were dated 07-08-74.

09-16-74 Corn samples were taken to determine yield. Plant density was 50,000 plants per hectare. Corn yield was 4060 kilograms per hectare (64.6 bushels per acre); stover, 6300 kilograms per hectare.

10-30-74 Post-harvest nutrient samples were taken with hydraulic sampler (eight increments to 152 centimeters).

1975 Cropping Season

04-21-75 Nutrient sampling sites were determined and each location was flagged. Each sampling hole was moved down watershed 3 feet from the 1974 season.

04-22-75 Background nutrient samples were taken (eight increments to 152 centimeters).

04-24-75 Pesticide background samples were taken (seven increments to 30 centimeters).

Fertilizer was applied at a rate of 22-31-0 kilograms per hectare of N (ammonium nitrate) and P (superphosphate), respectively, and incorporated.

05-21-75 Planting day.

Application rate of applied chemicals:

	Desired rate, kg/ha
Chloride (KCl source) (PPI)	112.00
2,4-D (Dacamine) (PE)	2.24
Atrazine (80W) (PE)	1.68
Cyanazine (80W) (PE)	1.68
Paraquat and Surfactant X77, 0.6 ml/L (PE) (calculated as dichloride salt)	1.53

The chloride was applied and incorporation/planting completed by 1000 hours. Pioneer 3009 (yellow) variety corn was planted, 54,000 plants per hectare.

Herbicides were applied between 1300 and 1345 hours. Three methods were used to monitor pesticide application:

1. Filter discs.
2. Time applicator while on watershed. Also, collected a nozzle sample for pesticide concentration and volume per unit time and distance (same as used for calibration).
3. Soil volume samples of the top 2.5 centimeters.

06-10-75 Nutrient samples were taken with hydraulic sampler from each sample area (eight increments to 152 centimeters).

06-24-75 Nutrient samples were taken with hydraulic sampler from each sample area (eight increments to 152 centimeters).

06-25-75 A solution of 2,4-D (Dow Formula 40) and nitrogen (50 percent urea and 50 percent ammonia) was applied at a rate of 0.56 kilograms per hectare of 2,4-D and 112 kilograms per hectare of nitrogen.

07-21-75 Nutrient samples were taken at grid-points with hydraulic sampler (eight increments to 152 centimeters).

10-03-75 Harvested corn, 5400 kilograms per hectare (86 bushels per acre) of corn grain and 6800 kilograms per hectare of stover.

10-30-75 Post-harvest nutrient sampling at grid-points with hydraulic sampler (eight increments to 152 centimeters).

P3 WATERSHED

<u>1972 Cropping Season</u>

05-18-72 Watershed tilled 20 centimeters deep using a moldboard plow.

06-16-72 Fertilizer applied at rates of 05-15-72 kilograms per hectare of N (ammonium nitrate), P (superphosphate), and K (muriate of potash), respectively, and incorporated with disk harrow.

06-30-72 Planting day.

Trifluralin application began at 1400 hours followed by incorporation and planting.

Coker 318 variety soybeans planted in rows spaced 90 centimeters apart.

Spraying of surface applied chemicals (paraquat and diphenamid completed by 1700 hours.

Application rate of applied chemicals:

	Desired rate, kg/ha
Trifluralin (PPI)	1.12
Diphenamid (Enide) (PE)	3.36
Paraquat and Surfactant X77, 0.6 ml/L (PE) (calculated as dichloride salt)	15.34

09-29-72 Winter rye aerially seeded prior to soybean leaf drop.

12-03-72 Harvested soybeans. Yield of 1280 kilograms per hectare (19 bushels per acre).

General Comments: Poor crop production was caused by late planting and water stress.

1973 Cropping Season

04-12-73 Winter rye was cut with rotary mower.

05-22-73 Fertilizer was applied at the rate of 21-19-53 kilograms per hectare of N (ammonium nitrate), P (superphosphate), and K (muriate of potash), respectively, and incorporated with disk harrow.

06-04-73 The watershed was refertilized and incorporated at a rate of 25-22-62 kilograms of N (ammonium nitrate), P (superphosphate), and K (muriate of potash), respectively. Rows were marked with a rolling cultivator as a guide for herbicide (trifluralin) application prior to planting. The rolling cultivator lightly tills the soil.

06-12-73 Pesticide background samples were taken (seven increments to 30 centimeters).

06-15-73 Planting day.

Planting began at 1200 hours.

Application rate of applied chemicals:

	Desired rate, kg/ha
Trifluralin (PPI)	1.12
Diphenamid (Enide) (PE)	3.36
Paraquat and Surfactant X77, 0.6 ml/L (PE) (calculated as dichloride salt)	1.53

Bragg variety soybeans were planted in rows spaced 9 centimeters apart. Post-plant pesticide soil core samples were taken (five increments to 15 centimeters). Also, USDA conducted a study on the volatilization of trifluralin.

10-05-73 Winter rye aerially seeded. Seeding was done prior to soybean leaf drop.

11-07-73 Soybeans harvested. Yield of 1410 kilograms per hectare (21 bushels per acre).

01-14-74 Emergence of aerially seeded rye was poor because of lack of rain. Rye was replanted with grain drill without tillage.

1974 Cropping Season

05-01-74 Winter rye yield samples were taken. The rye was cut and baled for hay to remove excessive amounts of residue.

05-22-74 Fertilizer was applied and incorporated at a rate of 17-15-41 kilograms per hectare of N (ammonium nitrate), P (superphosphate), and K (muriate of potash), respectively.

05-28-74 Watershed was cultivated with rolling cultivator to mark rows for herbicide application. Pesticide background samples were taken (seven increments to 30 centimeters).

05-30-74 Planting day.

Planting started at 0900 hours. Completed pesticide application at 1200 hours.

Application rate of applied chemicals:

	Desired rate, kg/ha
Trifluralin (PPI)	1.12
Diphenamid (Enide) (PE)	3.36
Paraquat and Surfactant X77, 0.6 ml/L (PE) (calculated as dichloride salt)	1.53

Essex variety of soybeans planted in rows spaced 90 centimeters apart. Filter discs were used to monitor pesticide application rate. A 0- to 1-centimeter soil sample was taken with spatula for pesticide analysis.

06-13-74 Rolling cultivator (depth of 5 centimeters) was used to control morning glory, sicklepod, and cocklebur weeds. Soil core samples were taken for effect on pesticide distribution.

07-05-74 Rolling cultivator used again to control weed population.

10-18-74 Soybeans harvested. Yield of 1680 kilograms per hectare (25 bushels per acre).

10-22-74 Watershed disced to level bedded rows prior to planting barley. Barsoy variety barley was planted at rate of 108 kilograms per hectare with a grain drill without further tillage.

1975 Cropping Season

04-15-75 Barley cut with rotary. Barley was serving as a green cover crop.

05-08-75 Fertilizer applied at the rate of 0-15-45 kilograms per hectare of N (ammonium nitrate), P (superphosphate), and K (muriate of potash), respectively.

05-13-75 Disk harrowed to incorporate fertilizer.

05-28-75 Planting day.

Application rate of applied chemicals:

	Desired rate, kg/ha
Trifluralin (PPI)	1.12
Diphenamid (Enide) (PE)	3.36
Paraquat and Surfactant X77, 0.6 ml/L (PE) (calculated as dichloride salt)	1.53

Bragg variety soybeans planted at a rate of 430,000 seeds per hectare (174,000 seeds per acre) in rows spaced 90 centimeters apart.

Trifluralin applied at 0830 hours. Filter discs used to monitor application in addition to timing application. Started taking soil volume samples at 0900 hours. Planting and incorporation was not completed until 1130 hours because of broken component in seed hopper of planter.

Paraquat and diphenamid compounds were applied between 1230 and 1300 hours. Air temperature was 85 degrees F. Applications were monitored by both filter discs and timing methods.

06-16-75 Watershed was cultivated (shallow with sweeps mounted on a Howard cultivator.

07-09-75 Watershed cultivated as on 06-16-75.

11-05-75 Harvested soybeans. Yield 2020 kilograms per hectare (30 bushels per acre).

11-18-75 Renovated grassed waterway (increased width to 24 feet).

P4 WATERSHED

1973 Cropping Season

04-18-73 Watershed tilled 20 centimeters deep with a moldboard plow.

05-05-73 Background pesticide samples were taken at depths of 0 to 7.5 and 7.5 to 15 centimeters.

05-11-73 Planting day.

A specially blended fertilizer (6-6-24) was applied at rates of 38.5-16.7-127 kilograms per hectare of N (inorganic derived from 3.68 percent ammonium sulfate and 2.35 percent diammonium phosphate), 2.6 percent P (derived from diammonium phosphate), and 19.9 percent K (derived from muriate of potash), respectively, and incorporated. Pioneer 3009 (yellow) variety corn was planted approximately 15 centimeters apart in rows spaced 90 centimeters apart.

Application rate of applied chemicals:

	Desired rate, kg/ha
Atrazine (80W) (PE)	3.36
Paraquat and Surfactant X77, 0.6 ml/L (PE) (calculated as dichloride salt)	1.53

Planting/pesticide application was complete by 1030 hours. Soil samples of 0 to 1 centimeter were taken immediately following the application of pesticide analysis. Soil samples were taken at depths of 0 to 7.5 and 7.5 to 15 centimeters for chloride analysis from the pesticide sampling areas.

05-14-73 Resampled the 0- to 1-centimeter soil zone because of a windstorm that occurred on planting day about 1900 hours.

05-30-73 Replanted corn in areas above terraces where topsoil was shallow and germination poor.

06-18-73 Nutrient samples were taken with hydraulic sampler (eight increments to 152 centimeters).

06-23-73 A solution of 2,4-D (Dow Formula 40) and nitrogen (50 percent urea and 50 percent ammonia) was applied at a rate of 0.56 kilograms per hectare and 112 kilograms per hectare, respectively. The 2,4-D was used to control morning glory and cocklebur.

10-05-73 Explorer variety rye was aerially seeded at a rate of 108 kilograms per hectare.

10-29-73 Corn yield samples taken. Results were 2967 kilograms per hectare (47.2 bushels per acre) of corn and 2520 kilograms per hectare of stover. The plant density was 41,000 plants per hectare.

11-01-73 Corn harvested.

11-02-73 Nutrient samples taken with hydraulic sampler (eight increments to 152 centimeters).

11-05-73 Replanted rye with grain drill because of low germination using the no-till procedure.

1974 Cropping Season

03-23-74 Sampled winter rye for yield.

03-24-74 Cut rye with rotary mower.

04-05-74 Disced watershed.

04-19-74 Pesticide background samples were taken (seven increments to 30 centimeters).

04-22-74 Background nutrient samples were taken with hydraulic sampler (eight increments to 152 centimeters).

04-23-74 Watershed disced.

04-29-74 Planting day.

A specially blended fertilizer (6-12-24) was applied at rates of 38-33-127 kilograms per hectare of N (inorganic derived from 1.31 percent ammonium sulfate and 4.69 percent diammonium phosphate), 5.24 percent P (derived from diammonium phosphate), and 19.9 percent K (derived from muriate of potash), respectively, and incorporated. Pioneer 3009 (yellow) variety corn was planted in rows spaced 90 centimeters apart.

Application rate of applied chemicals:

	Desired rate, kg/ha
Atrazine (80W) (PE)	3.36
Paraquat and Surfactant X77, 0.6 ml/L (PE) (calculated as dichloride salt)	1.53

The fertilizer application, planting/incorporation and pesticide application was completed by 1030 hours. Filter discs were used to monitor pesticide application. A 0- to 1-centimeter composite spatula sample was taken for pesticide analysis. Soil core samples were taken from the designated pesticide sampling areas by "split tube" method for nutrient analysis at depths of 0 to 7.5 and 7.5 to 15 centimeters.

05-06-74 Nutrient samples removed by "split tube" method from all pesticide sampling areas at depths of 0 to 7.5, 7.5 to 15, and 15 to 30 centimeters.

05-21-74 Nutrient samples taken with hydraulic sampler from each sampling area. Corn was about 20 centimeters tall. Soil hard and resistant at depths of 45 to 60 centimeters.

06-06-74 Nutrient samples taken with hydraulic sampler (eight increments to 152 centimeters).

06-11-74 A solution of 2,4-D (Dow Formula 40) and nitrogen (50 percent urea and 50 percent ammonia) was applied at a rate of 0.56 kilograms per hectare of 2,4-D and 107.16 kilograms per hectare of nitrogen. The nitrogen rate was determined by nozzle delivery rate and total time the applicator was on watershed. The desired rates were 112 kilograms per hectare of nitrogen. The solution was applied between 1430 and 1530 hours.

07-08-74 Nutrient samples taken manually with bucket auger from each sampling area (eight increments to 152 centimeters). Sampling started on 07-03-74 and finished on 07-15-74. All samples dated 07-08-74.

09-16-74 Corn samples taken for yield. Grain yield was 4840 kilograms per hectare (77 bushels per acre) and stover 7400 kilograms per hectare. Plant density was 41,000 plants per hectare.

10-19-74 Winter Explorer variety rye planted at a rate of 108 kilograms per hectare using a grain drill in a no-till procedure.

10-30-74 Post-harvest nutrient samples taken with hydraulic sampler (eight increments to 152 centimeters).

1975 Cropping Season

04-15-75 Mowed winter rye cover crop.

04-23-75 Background nutrient samples were taken (eight increments to 152 centimeters).

04-24-75 Pesticide background samples were taken (seven increments to 30 centimeters).

Fertilizer was applied at a rate of 22-21-0 kilograms per hectare for N (ammonium nitrate) and P (superphosphate), respectively. Watershed disced twice with heavy harrow. The plant residue incorporated was 2010 kilograms per hectare (oven-dry basis).

05-13-75 The watershed was disced for planting.

05-14-75 Planting day.

Application rate of applied chemicals:

	Desired rate, kg/ha
Chloride (KCl Source) (PPI)	112.00
2,4-D (Dacamine) (PE)	2.24
Atrazine (80W) (PE)	1.68
Cyanazine (80W) (PE)	1.68
Paraquat and Surfactant X77, 0.6 ml/L (PE) (calculated as dichloride salt)	1.53

The chloride was applied at 0830 hours. Incorporation and planting did not start until 1300 hours because of a faulty hydraulic system on tractor. Pioneer 3009 (yellow) variety corn was planted (51,000 plants per hectare) in rows spaced 90 centimeters. Pesticides were applied between 1345 and 1410 hours.

Three methods were used to monitor pesticide application:

1. Filter discs.
2. Applicator timed while on watershed. Also, collected a nozzle sample for pesticide concentration and volume per unit time and distance (same as used for calibration).
3. Soil volume sample of the surface 2.5 centimeters.

06-10-75 Nutrient samples taken with hydraulic sampler from each sampling area (eight increments to 152 centimeters).

06-16-75 Cultivated watershed with shallow running sweeps mounted on a Howard cultivator.

06-24-75 Nutrient samples taken with hydraulic sampler from each sampling area (eight increments to 152 centimeters).

06-25-75 A solution of 2,4-D (Dow Formula 40) and nitrogen (50 percent urea and 50 percent ammonia) applied at a rate of 0.56 kilograms per hectare of 2,4-D and 112 kilograms per hectare of nitrogen.

07-21-75 Nutrient samples taken with hydraulic sampler (eight increments to 152 centimeters).

10-30-75 Harvested corn on watershed. Yield 5190 kilograms per hectare (82 bushels per acre) of corn grain and 6000 kilograms per hectare of stover.

10-30-75 Post-harvest nutrient sampling with hydraulic sampler (eight increments to 152 centimeters).

11-18-75 Renovated grass waterway (increased width to 7.3 meters).

Appendix C

TABLE C1. WATERSHED P1, CROPPING YEAR 1972

DATE	RAINFALL, CM	RUNOFF, CM	TOTAL SEDIMENT, KG/HA	EROSIVITY INDEX (W)*
07/02/72	0.9	<0.1	0.0	2.1
07/03/72	0.5			1.4
07/04/72	0.1			0.0
07/05/72	0.8			1.7
07/24/72	0.1			0.1
07/28/72	2.5	0.8	1237.7	24.1
07/31/72	1.6	0.7	990.0	10.6
08/09/72	0.6			1.7
08/10/72	2.6	1.2	1393.5	33.1
08/11/72	0.4	<0.1	10.0	0.7
08/23/72	1.2	<0.1	1.3	8.3
08/27/72	0.6			1.7
09/04/72	1.8	<0.1	2.1	4.3
09/05/72	0.4			0.3
09/17/72	0.1			0.1
09/18/72	0.3			0.1
09/30/72	1.1			2.4
10/05/72	0.7			0.8
10/13/72	0.2			0.2
10/23/72	0.7			0.6
10/27/72	4.4	<0.1	15.8	18.3
11/03/72	0.3			0.2
11/07/72	2.4	<0.1	0.0	4.3
11/13/72	1.4	<0.1	0.0	6.1
11/19/72	2.5			4.4
11/25/72	2.1			2.4
11/30/72	0.5			0.2
12/05/72	2.2	<0.1	0.0	2.7
12/08/72	0.2			0.0
12/14/72	11.3	2.0	136.0	80.0
12/20/72	6.1	0.2	18.4	13.1
12/31/72	1.9			2.5
01/03/73	1.0			0.4
01/05/73	1.8	<0.1	0.0	1.9
01/07/73	4.7			0.3
01/19/73	1.1			1.4
01/21/73	1.3			1.1
01/22/73	2.5	<0.1	14.9	5.0
01/25/73	0.1			0.0
01/26/73	2.3	<0.1	2.1	2.9
01/28/73	0.2			0.0
02/01/73	4.9	0.7	334.2	15.4
02/06/73	0.2			0.1
02/08/73	0.6			0.6

TABLE C1 (continued). WATERSHED P1, CROPPING YEAR 1972

DATE	RAINFALL, CM	RUNOFF, CM	TOTAL SEDIMENT, KG/HA	EROSIVITY INDEX (W)
02/10/73	0.0			0.0
02/15/73	1.0			0.8
02/26/73	0.2			0.1
03/02/73	1.9			2.7
03/05/73	0.6			1.2
03/06/73	1.0	<0.1	0.1	1.5
03/09/73	1.0			3.0
03/11/73	4.6	0.6	183.7	25.7
03/16/73	5.2	1.6	2049.2	46.7
03/20/73	0.9			0.8
03/24/73	0.9			1.4
03/28/73	1.0			0.7
03/30/73	4.8	1.0	201.4	13.8
03/31/73	3.1	1.7	1446.4	30.4
04/08/73	8.6	1.5	817.0	35.9
04/24/73	2.5			8.1
04/25/73	0.5			0.2
04/26/73	0.4			0.2
04/28/73	1.1			3.1
05/05/73	1.8			2.5
05/19/73	3.4			9.5
05/23/73	2.4			13.3
05/28/73	5.5	3.0	9839.4	71.0
05/28/73	4.5	2.0	7422.5	36.3
06/01/73	0.5			0.2
06/05/73	0.8			1.2
06/06/73	3.7	2.0	13368.2	52.0
06/08/73	1.5			2.3
06/09/73	1.3	0.3	704.4	2.8
06/10/73	0.6	0.2	305.7	0.4

*To convert to English units, foot tons inches/acre hour, divide by 1.735.

TABLE C2. WATERSHED P3, CROPPING YEAR 1972

DATE	RAINFALL, CM	RUNOFF, CM	TOTAL SEDIMENT, KG/HA	EROSIVITY INDEX (W)
07/02/72	1.1	<0.1	1.7	6.5
07/02/72	1.9	0.3	444.0	9.3
07/03/72	0.8			3.3
07/05/72	0.6	<0.1	1.5	0.8
07/28/72	2.0	1.0	394.1	19.1
07/29/72	0.5	0.1	26.3	0.9
07/31/72	1.1	0.6	384.1	6.0
08/09/72	0.8	0.1	24.8	2.7
08/10/72	1.1	0.5	139.7	6.0
08/23/72	1.7	0.5	134.2	6.4
09/04/72	4.9	2.1	414.7	72.8
09/17/72	0.1			0.0
09/18/72	0.3			0.2
09/18/72	0.3			0.2
09/30/72	1.3			3.8
10/05/72	0.6			0.5
10/13/72	0.2			0.2
10/23/72	0.7			0.6
10/27/72	3.2			6.6
10/28/72	0.2			0.1
11/03/72	0.3			0.1
11/07/72	2.5	<0.1	0.5	4.1
11/13/72	1.1	<0.1	0.2	3.4
11/19/72	2.6	<0.1	0.7	4.4
11/25/72	2.0	<0.1	0.3	2.1
11/25/72	0.2			0.1
11/30/72	0.5			0.2
12/05/72	2.2	<0.1	0.0	3.0
12/14/72	11.7	3.8	224.2	90.0
12/20/72	0.5			0.9
12/21/72	4.6	0.5	34.4	9.0
12/22/72	2.3			7.7
12/31/72	1.4			1.6
12/31/72	0.6			0.3
01/03/73	1.1			0.4
01/05/73	1.8			1.9
01/07/73	0.7			0.3
01/19/73	1.3			2.2
01/21/73	2.7	1.7	310.1	10.0
01/25/73	2.4	0.2	9.7	3.9
01/28/73	0.1			0.0
02/01/73	5.0	1.0	115.4	20.3
02/06/73	0.2			0.1
02/08/73	0.6			0.8

TABLE C2 (continued). WATERSHED P3, CROPPING YEAR 1972

DATE	RAINFALL, CM	RUNOFF, CM	TOTAL SEDIMENT, KG/HA	EROSIVITY INDEX (W)
02/15/73	1.1			1.5
02/25/73	0.2			0.2
02/26/73	0.2			0.1
03/02/73	1.7			1.7
03/05/73	0.7			2.1
03/06/73	1.0	<0.1	0.2	1.5
03/09/73	0.9			1.8
03/11/73	4.4	1.0	45.5	22.3
03/16/73	5.0	2.0	261.2	37.4
03/20/73	1.0			0.9
03/28/73	1.3			0.3
03/30/73	4.8	1.7	68.0	12.4
03/31/73	3.2	1.8	227.5	34.1
04/06/73	0.1			0.1
04/07/73	6.4	1.8	487.5	21.4
04/20/73	2.8			7.3
04/24/73	0.3			0.0
04/25/73	0.2			0.2
04/26/73	0.3			0.2
05/02/73	1.0			2.0
05/08/73	1.6			2.7
05/19/73	2.6			8.1
05/23/73	2.2			10.9
05/28/73	4.8	1.6	1122.1	54.7
05/28/73	4.3	1.9	1618.5	30.9
06/01/73	0.6			0.6
06/05/73	1.2			2.7
06/06/73	3.9	0.6	405.4	64.6
06/07/73	2.2			8.1
06/08/73	1.2	0.5	729.7	0.5
06/13/73	0.9			3.4

TABLE C3. WATERSHED P1, CROPPING YEAR 1973

DATE	RAINFALL, CM	RUNOFF, CM	TOTAL SEDIMENT, KG/HA	EROSIVITY INDEX (W)
06/13/73	1.9	1.4	6069.5	21.6
06/20/73	0.1			0.0
06/21/73	1.9	0.4	876.5	14.5
06/25/73	0.3			0.3
06/28/73	0.4			0.9
06/28/73	0.4	<0.1	96.0	0.7
07/08/73	1.8	0.5	504.0	6.8
07/16/73	0.9			2.9
07/17/73	0.8	<0.1	49.4	2.2
07/25/73	0.4			0.2
07/30/73	2.8	1.3	1453.5	45.1
08/01/73	0.6			1.0
08/17/73	1.1	<0.1	5.0	5.7
08/18/73	0.9	0.1	62.7	3.2
08/31/73	0.5			0.9
09/03/73	0.7			2.5
09/09/73	4.1	1.5	784.5	40.6
09/13/73	3.2	0.8	354.6	28.0
09/14/73	0.7			1.0
09/17/73	0.4			0.3
09/18/73	0.5			0.7
09/27/73	0.8			1.0
09/28/73	0.4			0.3
09/30/73	1.4			4.5
10/30/73	0.7			0.7
11/21/73	2.1			9.8
11/25/73	0.6			0.7
11/26/73	0.4			0.7
11/28/73	1.4			1.5
12/04/73	0.2			0.2
12/05/73	4.0	<0.1	4.4	22.0
12/15/73	1.7			2.2
12/16/73	0.3			0.1
12/20/73	1.9	<0.1	1.7	6.8
12/25/73	1.2			1.6
12/26/73	0.6			0.7
12/30/73	2.3			6.3
12/31/73	5.3	1.8	846.5	39.7
01/02/74	0.4			0.8
01/03/74	0.9			1.6
01/04/74	0.4			0.3
01/07/74	0.9			0.9
01/11/74	0.2			0.2
01/20/74	2.2	<0.1	1.0	4.3

TABLE C3 (continued). WATERSHED P1, CROPPING YEAR 1973

DATE	RAINFALL, CM	RUNOFF, CM	TOTAL SEDIMENT, KG/HA	EROSIVITY INDEX (W)
01/24/74	0.6			0.3
01/28/74	0.3			0.1
01/29/74	0.7			0.3
02/06/74	4.3	0.4	96.0	16.1
02/07/74	0.5			0.2
02/14/74	1.7			1.2
02/15/74	2.3	<0.1	0.0	1.5
02/19/74	0.4			0.6
02/22/74	1.3	<0.1	4.9	3.4
03/19/74	0.4			0.2
03/21/74	1.7			8.6
03/25/74	0.9			0.3
03/27/74	0.2			0.1
03/29/74	1.9	<0.1	34.2	7.9
04/04/74	3.3	0.9	753.6	26.2
04/12/74	0.1			0.1
04/13/74	2.3	0.4	172.5	21.1
04/13/74	0.1			0.0
04/22/74	0.8			0.9
05/02/74	0.2			0.2
05/04/74	0.9			4.1
05/05/74	1.9			7.1
05/12/74	1.6			5.7
05/15/74	0.1			0.1
05/23/74	6.4			54.3
05/26/74	0.6			0.3

TABLE C4. WATERSHED P2, CROPPING YEAR 1973

DATE	RAINFALL, CM	RUNOFF, CM	TOTAL SEDIMENT, KG/HA	EROSIVITY INDEX (W)
05/19/73	1.2	<0.1	1.8	4.0
05/23/73	1.9	0.6	716.6	10.8
05/28/73	5.6	4.0	4337.2	74.4
05/28/73	5.3	3.4	3897.8	45.4
06/05/73	0.7			1.2
06/06/73	3.1	2.2	1107.9	38.2
06/08/73	1.7			2.4
06/09/73	1.1	0.1	26.5	2.5
06/10/73	0.6	<0.1	19.3	0.4
06/13/73	2.0	0.7	530.1	11.2
06/20/73	0.5			1.3
06/21/73	0.9			4.1
06/21/73	0.9	0.5	171.5	4.1
06/25/73	0.3			0.5
06/28/73	0.6			2.1
06/28/73	0.3			0.5
07/08/73	4.1	1.9	422.1	37.6
07/14/73	0.5			1.2
07/16/73	0.1			0.1
07/17/73	1.1			3.7
07/25/73	0.3			0.1
07/25/73	0.6			0.6
07/26/73	0.2			0.1
07/27/73	0.2			0.1
07/30/73	2.0	<0.1	2.1	22.3
09/03/73	0.7			1.8
09/09/73	5.0	0.4	23.9	59.7
09/10/73	0.1			0.1
09/13/73	1.1			2.1
09/13/73	2.1	0.7	33.1	14.7
09/17/73	1.1			1.9
09/27/73	0.5			0.5
09/28/73	0.8			2.2
09/30/73	1.3			3.8
10/30/73	0.7			0.7
11/21/73	2.1			9.8
11/25/73	0.6			0.7
11/26/73	0.4			0.7
11/28/73	1.4			1.5
12/04/73	0.2			0.2
12/06/73	4.0	<0.1	1.8	22.4
12/15/73	1.7			2.2
12/16/73	0.3			0.1
12/20/73	1.9	<0.1	1.2	6.8

TABLE C4 (continued). WATERSHED P2, CROPPING YEAR 1973

DATE	RAINFALL, CM	RUNOFF, CM	TOTAL SEDIMENT, KG/HA	EROSIVITY INDEX (W)
12/25/73	1.2			1.6
12/26/73	0.6			0.7
12/30/73	2.3	<0.1	0.4	6.3
12/31/73	5.3	1.1	54.1	39.7
01/02/74	0.4			0.8
01/03/74	0.9			1.6
01/04/74	0.4			0.3
01/07/74	0.9			0.9
01/11/74	0.2			0.2
01/20/74	2.2	<0.1	0.8	4.3
01/24/74	0.6			0.4
01/28/74	0.3			0.1
01/29/74	0.7			0.3
02/06/74	4.3	0.2	0.0	16.1
02/07/74	0.5	<0.1	0.0	0.2
02/14/74	1.7			1.2
02/15/74	2.3	<0.1	0.0	1.5
02/19/74	0.4			0.6
02/22/74	1.3	<0.1	0.0	3.4
03/19/74	0.4			0.2
03/21/74	1.7			8.6
03/25/74	0.9			0.3
03/27/74	0.2			0.1
03/29/74	1.8	<0.1	0.9	7.2

TABLE C5. WATERSHED P3, CROPPING YEAR 1973

DATE	RAINFALL, CM	RUNOFF, CM	TOTAL SEDIMENT, KG/HA	EROSIVITY INDEX (W)
06/20/73	1.0			5.3
06/21/73	0.5			0.9
06/28/73	0.6			0.9
07/04/73	0.1			0.1
07/08/73	6.4	2.6	1184.4	101.6
07/14/73	1.9	0.6	210.9	20.7
07/16/73	0.3			0.3
07/17/73	0.9	0.2	65.8	2.7
07/23/73	1.3			3.5
07/25/73	0.9			0.8
07/28/73	0.3			0.2
07/31/73	0.3			0.3
08/01/73	0.6			0.8
08/06/73	0.1			0.1
08/14/73	0.6			2.1
08/17/73	0.3			0.1
08/18/73	0.4			0.5
08/31/73	0.3			0.3
09/03/73	0.4			0.6
09/09/73	4.4	1.5	57.8	46.7
09/10/73	0.8			2.8
09/13/73	3.4	0.7	25.1	30.4
09/14/73	0.7			0.9
09/17/73	1.3			2.9
09/27/73	0.5			0.4
09/28/73	0.6			1.9
09/30/73	1.4			4.3
10/31/73	0.5			0.5
11/21/73	2.1			11.3
11/25/73	0.8			2.8
11/26/73	0.1			0.1
11/28/73	1.3			1.2
12/04/73	0.1			0.0
12/05/73	3.9			19.5
12/15/73	2.0			3.5
12/20/73	2.6	0.3	38.6	17.4
12/25/73	2.1			3.9
12/29/73	0.3			0.4
12/30/73	1.9			5.3
12/31/73	5.4	0.9	78.0	40.2
01/03/74	1.0			1.2
01/04/74	0.5			0.3
01/07/74	1.0			1.4
01/11/74	0.1			0.1

TABLE C5 (continued). WATERSHED P3, CROPPING YEAR 1973

DATE	RAINFALL, CM	RUNOFF, CM	TOTAL SEDIMENT, KG/HA	EROSIVITY INDEX (W)
01/20/74	2.3	<0.1	3.4	3.8
01/24/74	0.6			0.7
01/28/74	0.6			0.3
01/29/74	0.6			0.3
02/02/74	0.4			0.7
02/06/74	3.7			9.4
02/07/74	0.9			0.4
02/14/74	1.8			1.3
02/15/74	2.5			1.9
02/19/74	0.4			0.6
02/22/74	1.3			3.0
03/19/74	0.5			0.3
03/21/74	1.5			7.3
03/25/74	1.0			0.4
03/27/74	0.2			0.1
03/29/74	1.8			7.2
04/04/74	3.6			26.2
04/12/74	0.1			0.1
04/13/74	2.5	0.2	41.9	25.2
04/22/74	0.8			1.0
05/02/74	0.3			0.2
05/04/74	0.1			0.1
05/05/74	1.5			6.5
05/11/74	1.1			1.6
05/15/74	0.2			0.2
05/23/74	6.9			61.6
05/26/74	0.6			0.6

TABLE C6. WATERSHED P4, CROPPING YEAR 1973

DATE	RAINFALL, CM	RUNOFF, CM	TOTAL SEDIMENT, KG/HA	EROSIVITY INDEX (W)
05/23/73	1.2	<0.1	9.8	6.3
05/24/73	1.0			2.4
05/28/73	4.8	2.5	1166.3	54.7
05/28/73	4.3	2.4	1169.0	30.9
06/01/73	0.6			0.6
06/05/73	1.0			2.4
06/06/73	3.9	2.0	576.9	65.0
06/07/73	2.3			8.2
06/07/73	1.1	0.6	200.2	0.3
06/13/73	0.9	0.1	30.9	3.4
06/20/73	1.0			4.8
06/21/73	0.5			0.9
06/28/73	0.6			1.2
06/28/73	0.6			0.9
07/04/73	0.3			0.4
07/08/73	6.4	2.9	547.9	101.6
07/14/73	1.9	0.4	43.0	18.8
07/16/73	0.3			0.5
07/17/73	0.9	<0.1	8.3	2.7
07/23/73	1.3			3.5
07/25/73	0.9			0.8
07/28/73	0.3			0.2
07/31/73	0.3			0.3
08/01/73	0.6			0.8
08/06/73	0.1			0.1
08/14/73	0.6			2.1
08/17/73	0.3			0.1
08/18/73	0.4			0.5
08/31/73	0.3			0.3
09/03/73	0.4			0.6
09/09/73	4.4	1.2	64.5	46.8
09/10/73	0.8			2.9
09/13/73	3.4	0.9	60.1	30.4
09/14/73	0.8			1.1
09/17/73	1.3			2.9
09/27/73	0.5			0.4
09/28/73	0.6			1.9
09/30/73	1.4			4.3
10/31/73	0.5			0.5
11/21/73	2.1			11.3
11/25/73	0.8			2.8
11/26/73	0.1			0.1
11/28/73	1.3			1.2
12/04/73	0.1			0.0

TABLE C6 (continued). WATERSHED P4, CROPPING YEAR 1973

DATE	RAINFALL, CM	RUNOFF, CM	TOTAL SEDIMENT, KG/HA	EROSIVITY INDEX (W)
12/05/73	3.9	<0.1	4.6	19.5
12/15/73	2.0			3.5
12/20/73	2.6	0.3	18.4	17.4
12/25/73	2.1	<0.1	3.4	3.9
12/29/73	0.3			0.4
12/30/73	1.9	<0.1	2.5	5.3
12/31/73	5.4	3.0	97.6	40.2
01/03/74	1.0			1.2
01/04/74	0.5			0.3
01/07/74	1.0			1.4
01/11/74	0.1			0.1
01/20/74	2.3	0.1	2.6	4.0
01/24/74	0.6			0.7
01/28/74	0.6			0.3
01/29/74	0.6			0.3
02/02/74	0.4			0.7
02/06/74	3.7	0.9	0.0	9.4
02/07/74	0.9	<0.1	0.0	0.4
02/14/74	1.8	<0.1	0.0	1.3
02/15/74	2.5	0.7	0.0	1.7
02/19/74	0.4			0.6
02/22/74	1.3			3.0
03/19/74	0.5			0.3
03/21/74	1.5			7.3
03/25/74	1.0			0.4
03/27/74	0.2			0.1
03/29/74	1.8			7.2
04/04/74	3.6	0.7	249.0	27.5
04/12/74	0.1			0.1
04/13/74	2.5	0.2	14.6	25.2
04/22/74	0.8			1.0

TABLE C7. WATERSHED P1, CROPPING YEAR 1974

DATE	RAINFALL, CM	RUNOFF, CM	TOTAL SEDIMENT, KG/HA	EROSIVITY INDEX (W)
05/31/74	1.0			2.6
06/08/74	0.8			0.9
06/10/74	0.7			0.7
06/20/74	1.3	0.2	230.9	7.0
06/27/74	3.6	1.1	812.2	22.9
06/27/74	5.5	4.8	5939.6	151.8
07/06/74	0.9	<0.1	51.3	3.0
07/17/74	0.3			0.4
07/23/74	0.4			0.3
07/24/74	0.9	<0.1	55.3	3.2
07/26/74	2.9	1.5	976.2	28.0
07/27/74	8.6	7.6	2607.3	197.9
08/05/74	0.2			0.2
08/07/74	2.4			4.2
08/10/74	1.9	0.4	181.9	21.5
08/14/74	0.7			1.4
08/16/74	5.3	1.6	293.7	54.4
08/17/74	1.7	0.2	21.1	5.7
08/29/74	1.7			11.0
09/01/74	1.1			7.2
09/03/74	0.9			4.0
09/06/74	2.2			1.2
09/25/74	0.5			0.2
11/05/74	0.7			1.1
11/11/74	0.7			0.6
11/14/74	0.8			0.2
11/17/74	2.0			1.8
11/20/74	1.4			6.1
11/30/74	3.4			5.2
12/07/74	1.1			0.6
12/15/74	3.0	<0.1	1.8	8.9
12/19/74	2.2	<0.1	0.3	3.3
12/24/74	2.0			1.0
12/24/74	0.4			0.3
12/25/74	0.6			0.6
12/27/74	0.2			0.1
12/29/74	2.3	<0.1	0.3	4.4
01/03/75	0.4			0.2
01/04/75	0.6			0.4
01/08/75	1.5			1.2
01/10/75	2.8	0.1	11.8	20.9
01/12/75	2.5	0.2	4.0	5.5
01/19/75	0.6			1.3
01/20/75	0.9			1.3

TABLE C7 (continued). WATERSHED P1, CROPPING YEAR 1974

DATE	RAINFALL, CM	RUNOFF, CM	TOTAL SEDIMENT, KG/HA	EROSIVITY INDEX (W)
01/23/75	0.3			0.0
01/24/75	2.7	0.2	0.6	5.9
01/25/75	0.3			0.3
02/03/75	1.1			0.9
02/04/75	3.6	<0.1	0.2	3.3
02/05/75	1.1			1.0
02/11/75	1.1			2.8
02/16/75	2.4	<0.1	0.2	8.7
02/16/75	1.1			1.5
02/17/75	0.3			0.3
02/18/75	4.2	1.2	52.8	28.4
02/22/75	0.1			0.1
02/24/75	2.8	0.2	3.5	18.7
03/07/75	0.9			3.9
03/10/75	0.5			0.7
03/10/75	0.6			2.0
03/11/75	0.5			0.5
03/12/75	2.0	0.2	0.5	8.3
03/13/75	10.9	5.1	79.6	90.7
03/16/75	1.8	<0.1	0.1	2.0
03/18/75	3.9	0.3	0.7	9.4
03/24/75	2.5	<0.1	0.2	13.9
03/30/75	1.4			8.5
04/02/75	5.8	2.6	7.9	60.6
04/09/75	0.5			0.4
04/11/75	0.1			0.0
04/14/75	0.9			0.4
04/14/75	1.2			1.4
04/30/75	0.6			1.0
05/01/75	0.2			0.1
05/03/75	3.5			15.4
05/07/75	4.3	0.1	11.7	31.0
05/14/75	1.8			12.1
05/16/75	1.7			6.6
05/29/75	0.3			0.2
05/31/75	3.6			36.1

TABLE C8. WATERSHED P2, CROPPING YEAR 1974

DATE	RAINFALL, CM	RUNOFF, CM	TOTAL SEDIMENT, KG/HA	EROSIVITY INDEX (W)
04/04/74	3.3	0.3	9.6	26.2
04/12/74	0.1			0.1
04/13/74	2.3	0.4	14.5	21.1
04/13/74	0.1			0.0
04/22/74	0.8			0.9
05/02/74	0.2			0.2
05/04/74	0.9			4.1
05/05/74	1.9	<0.1	10.1	7.2
05/11/74	0.3			0.1
05/12/74	1.3			5.1
05/15/74	0.3			0.2
05/23/74	7.0	0.7	92.0	51.7
05/26/74	0.7			0.6
05/31/74	1.3			4.1
06/08/74	0.8			0.7
06/10/74	0.6			0.8
06/20/74	1.2	<0.1	1.4	6.5
06/27/74	5.4	1.2	226.4	32.7
06/27/74	5.4	3.0	740.1	174.6
07/17/74	0.3			0.3
07/23/74	0.3			0.1
07/24/74	1.5	0.1	23.4	10.4
07/26/74	1.3			6.0
07/27/74	7.2	4.5	661.3	288.1
08/05/74	0.1			0.1
08/07/74	2.7			7.0
08/10/74	2.8	0.2	22.6	44.9
08/14/74	0.8			1.8
08/16/74	5.1	0.8	70.7	64.7
08/17/74	1.5	0.1	7.3	6.9
08/29/74	1.7	<0.1	3.8	10.9
09/01/74	1.1	<0.1	0.5	7.2
09/03/74	0.8			3.3
09/06/74	2.3			1.6
09/25/74	0.4			0.1
10/16/74	0.9			0.8
11/05/74	0.7			1.3
11/11/74	0.8			0.5
11/20/74	1.5			7.7
12/07/74	1.1			0.8
12/15/74	3.1	<0.1	0.0	8.9
12/19/74	2.2	<0.1	0.0	3.3
12/20/74	0.5			0.3
12/24/74	2.2			3.0

TABLE C8 (continued). WATERSHED P2, CROPPING YEAR 1974

DATE	RAINFALL, CM	RUNOFF, CM	TOTAL SEDIMENT, KG/HA	EROSIVITY INDEX (W)
12/24/74	0.2			0.2
12/25/74	0.2			0.1
12/25/74	0.5			0.4
12/27/74	0.2			0.1
12/29/74	2.3	<0.1	0.0	4.7
01/03/75	0.4			0.2
01/04/75	0.9			0.6
01/08/75	1.5			1.2
01/10/75	2.6	<0.1	3.1	17.5
01/12/75	2.3	<0.1	0.2	5.1
01/19/75	1.6			3.6
01/23/75	0.3			0.0
01/24/75	2.7	<0.1	0.1	6.1
01/24/75	0.0			0.0
01/25/75	0.5			0.4
02/03/75	1.0			0.7
02/04/75	3.6	0.2	2.2	3.3
02/05/75	1.1			1.0
02/11/75	1.1			2.8
02/16/75	2.4			8.6
02/16/75	1.5			1.8
02/17/75	2.5	<0.1	0.7	15.5
02/18/75	2.1	0.6	6.6	9.9
02/22/75	0.0			0.0
02/24/75	2.8	<0.1	3.8	18.7
03/07/75	0.9			4.1
03/10/75	0.7			2.1
03/11/75	0.5			0.5
03/12/75	2.3			12.7
03/13/75	9.4	4.6	58.2	105.8
03/14/75	1.8			7.1
03/16/75	1.8	<0.1	0.9	2.0
03/18/75	1.1			0.7
03/18/75	2.1	0.1	0.3	3.8
03/24/75	2.8			14.4
03/30/75	1.4			8.8
04/02/75	6.5			80.0
04/09/75	0.5			0.3
04/10/75	0.1			0.1
04/11/75	0.1			0.0
04/14/75	0.9			0.4
04/14/75	1.2			1.4
04/30/75	0.6			0.9
05/01/75	0.3			0.2

TABLE C8 (continued). WATERSHED P2, CROPPING YEAR 1974

DATE	RAINFALL, CM	RUNOFF, CM	TOTAL SEDIMENT, KG/HA	EROSIVITY INDEX (*)
05/03/75	3.5			15.4
05/07/75	4.3			31.0
05/14/75	1.8			11.3
05/16/75	1.7			6.4

TABLE C9. WATERSHED P3, CROPPING YEAR 1974

DATE	RAINFALL, CM	RUNOFF, CM	TOTAL SEDIMENT, KG/HA	EROSIVITY INDEX (W)
05/31/74	1.4			6.8
06/08/74	1.1			3.7
06/10/74	0.6			1.1
06/20/74	1.0			4.3
06/27/74	5.3	0.8	195.6	68.9
06/27/74	3.3	1.1	556.9	50.0
07/03/74	0.4			0.5
07/05/74	0.3			0.3
07/17/74	0.1			0.1
07/23/74	0.4			0.5
07/24/74	1.2			5.8
07/27/74	7.7	1.7	537.4	168.9
08/05/74	0.9			4.3
08/07/74	2.3			3.1
08/14/74	1.3	<0.1	0.6	5.0
08/16/74	4.4	0.8	226.5	65.1
08/17/74	1.1			2.6
08/29/74	2.5	0.2	41.5	26.4
09/01/74	1.3	<0.1	16.9	8.9
09/03/74	0.8			2.9
09/06/74	2.3			1.2
09/21/74	0.2			0.1
10/15/74	0.8			1.1
11/05/74	0.7			1.3
11/11/74	0.8			0.6
11/14/74	0.6			0.3
11/17/74	1.7			1.4
11/20/74	1.3			4.9
11/30/74	3.6			6.8
12/07/74	1.1			0.5
12/15/74	3.1	<0.1	1.0	9.2
12/19/74	2.2	<0.1	4.1	2.7
12/20/74	0.4			0.1
12/24/74	2.1			1.2
12/24/74	0.2			0.1
12/25/74	0.3			0.2
12/27/74	0.3			0.0
12/29/74	2.3	<0.1	0.0	5.5
01/03/75	0.5			0.2
01/04/75	0.6			0.7
01/08/75	1.7			0.8
01/10/75	2.6	<0.1	22.4	17.0
01/12/75	3.1	0.7	75.2	11.5
01/19/75	0.6			1.4

TABLE C9 (continued). WATERSHED P3, CROPPING YEAR 1974

DATE	RAINFALL, CM	RUNOFF, CM	TOTAL SEDIMENT, KG/HA	EROSIVITY INDEX (W)
01/24/75	1.3			0.6
02/04/75	0.0			0.0
02/16/75	2.6	<0.1	3.5	9.8
02/16/75	1.3			1.4
02/17/75	0.3			0.3
02/18/75	4.5	0.5	46.7	26.8
02/22/75	0.9			0.2
02/24/75	2.4	0.5	97.0	11.0
03/07/75	0.6			2.2
03/10/75	0.6			0.7
03/10/75	0.6			1.3
03/11/75	0.5			0.4
03/12/75	1.9			6.6
03/13/75	10.0	3.6	257.8	116.5
03/14/75	3.7			20.2
03/16/75	1.8	<0.1	0.9	3.8
03/18/75	0.8			0.4
03/18/75	1.1	<0.1	0.4	0.6
03/18/75	1.0			1.5
03/24/75	2.6	0.3	23.7	16.0
03/30/75	1.5			9.0
03/30/75	1.5			7.1
04/02/75	7.0	5.8	305.4	110.9
04/09/75	0.5			0.3
04/10/75	0.6			1.5
04/11/75	0.1			0.0
04/14/75	1.0			0.5
04/14/75	1.3			0.7
04/30/75	0.9			2.9
05/01/75	0.3			0.3
05/03/75	3.9			20.9
05/07/75	2.8			13.5
05/14/75	1.9			9.6
05/16/75	1.4			3.3

TABLE C10. WATERSHED P4, CROPPING YEAR 1974

DATE	RAINFALL, CM	RUNOFF, CM	TOTAL SEDIMENT, KG/HA	EROSIVITY INDEX (W)
05/02/74	0.3			0.2
05/04/74	0.1			0.1
05/05/74	1.5			6.5
05/11/74	1.1			1.6
05/15/74	0.2			0.2
05/23/74	6.9	0.2	13.3	61.6
05/26/74	0.6			0.6
05/31/74	1.4			6.8
06/08/74	1.1			3.7
06/10/74	0.6			1.1
06/20/74	1.0			4.3
06/27/74	5.3	0.6	65.4	79.1
06/27/74	3.3	1.6	250.6	50.0
07/03/74	0.4			0.5
07/05/74	0.3			0.3
07/17/74	0.1			0.1
07/23/74	0.4			0.5
07/24/74	1.2			5.8
07/27/74	7.6	2.6	87.8	168.3
08/05/74	0.9			4.3
08/07/74	2.3			3.1
08/14/74	1.3			5.0
08/16/74	4.4	0.5	29.7	65.1
08/17/74	1.1			2.6
08/29/74	2.5	<0.1	1.9	26.4
09/01/74	1.3			8.9
09/03/74	0.8			2.9
09/06/74	2.3			1.2
09/21/74	0.2			0.1
10/15/74	0.8			1.1
11/05/74	0.7			1.3
11/11/74	0.8			0.6
11/14/74	0.6			0.3
11/17/74	1.7			1.4
11/20/74	1.3			4.9
11/30/74	3.6			6.8
12/07/74	1.1			0.5
12/15/74	3.2	<0.1	0.5	9.3
12/19/74	2.2	<0.1	1.9	2.7
12/20/74	0.4			0.1
12/24/74	2.1			1.2
12/24/74	0.2			0.1
12/25/74	0.3			0.2
12/27/74	0.3			0.0

TABLE C10.(continued). WATERSHED P4, CROPPING YEAR 1974

DATE	RAINFALL, CM	RUNOFF, CM	TOTAL SEDIMENT, KG/HA	EROSIVITY INDEX (W)
12/29/74	2.3	<0.1	3.8	5.5
01/03/75	0.5			0.2
01/04/75	0.6			0.7
01/08/75	1.7			0.7
01/10/75	2.5	0.3	52.2	16.3
01/12/75	3.1	0.8	82.6	11.5
01/19/75	0.6			1.4
01/24/75	1.3	0.3	30.5	0.6
02/04/75	0.0	0.5	24.3	0.0
02/16/75	2.6	<0.1	2.8	9.8
02/16/75	1.5	<0.1	6.9	2.0
02/17/75	0.3			0.4
02/18/75	4.4	1.3	106.2	26.1
02/22/75	0.9			0.2
02/24/75	2.4	0.5	37.5	11.0
03/07/75	0.6			2.2
03/10/75	0.6			0.7
03/10/75	0.6			1.3
03/11/75	0.5			0.4
03/12/75	1.9			6.5
03/13/75	10.0	5.5	314.6	116.5
03/14/75	0.0			0.0
03/16/75	1.8	<0.1	4.2	3.8
03/18/75	2.8	0.7	22.3	3.6
03/24/75	2.6	0.3	14.8	16.0
03/30/75	1.5			9.0
04/02/75	7.0			110.5
04/09/75	0.5			0.3
04/10/75	0.6			1.5
04/11/75	0.1			0.0
04/14/75	1.0			0.5
04/14/75	1.3			0.7
04/30/75	0.9			2.9
05/01/75	0.3			0.3
05/03/75	3.9			20.9
05/07/75	2.8			13.5

TABLE C11. WATERSHED P1, CROPPING YEAR 1975

DATE	RAINFALL, CM	RUNOFF, CM	TOTAL SEDIMENT, KG/HA	EROSIVITY INDEX (W)
06/10/75	1.1			4.0
06/11/75	2.4			15.5
06/11/75	4.7	2.5	15.3	107.7
06/18/75	0.1			0.1
06/19/75	0.6			1.9
07/02/75	1.1			1.3
07/06/75	0.4			0.4
07/10/75	0.9			2.0
07/13/75	2.5	<0.1	1.2	42.2
07/14/75	0.1			0.1
07/16/75	0.2			0.0
07/17/75	0.4			0.3
07/17/75	0.6			1.6
07/20/75	0.1			0.0
07/24/75	4.3	<0.1	0.4	40.4
08/01/75	0.9			4.2
08/04/75	0.5			0.8
08/06/75	0.4			0.3
08/07/75	0.5			0.5
08/26/75	3.0			18.6
08/27/75	0.6			0.6
09/06/75	1.3			4.4
09/07/75	0.1			0.1
09/10/75	1.0			4.2
09/12/75	1.4			7.9
09/17/75	5.1	<0.1	0.5	47.4
09/22/75	3.6	<0.1	0.0	10.2
09/23/75	1.1			5.0
10/01/75	0.9			0.6

TABLE C12. WATERSHED P2, CROPPING YEAR 1975

DATE	RAINFALL, CM	RUNOFF, CM	TOTAL SEDIMENT, KG/HA	EROSIVITY INDEX (W)
05/29/75	0.3			0.2
05/31/75	3.6	0.4	215.9	34.9
06/10/75	1.1			4.0
06/11/75	2.4	0.7	295.0	15.5
06/11/75	4.7	3.3	3827.5	107.7
06/18/75	0.1			0.1
06/19/75	0.6	0.1	2.1	1.9
07/02/75	1.1			1.3
07/06/75	0.4			0.4
07/10/75	0.9			2.0
07/13/75	2.7	0.8	320.6	46.6
07/14/75	0.1			0.1
07/16/75	0.2			0.0
07/17/75	0.4			0.3
07/17/75	0.6			1.6
07/20/75	0.1			0.0
07/24/75	4.3	2.4	427.9	40.6
07/28/75	0.1			0.1
07/29/75	0.9			1.4
08/01/75	0.9	0.1	7.4	4.2
08/04/75	0.5			0.8
08/06/75	0.4			0.3
08/07/75	0.5			0.5
08/26/75	3.0			19.5
08/27/75	0.6			0.6
09/06/75	1.3			4.4
09/07/75	0.1			0.1
09/10/75	1.0			4.2
09/12/75	1.4			7.9
09/17/75	5.1			47.4
09/22/75	3.6			10.2
09/23/75	1.1	<0.1	5.9	5.0
10/01/75	0.9			0.6

TABLE C13. WATERSHED P3, CROPPING YEAR 1975

DATE	RAINFALL, CM	RUNOFF, CM	TOTAL SEDIMENT, KG/HA	EROSIVITY INDEX (W)
05/28/75	0.5			0.6
05/29/75	0.6			0.6
05/31/75	3.6			29.4
06/10/75	0.9			1.5
06/11/75	2.7	0.3	73.4	28.6
06/11/75	2.5	0.6	168.4	23.6
06/18/75	0.8			2.2
06/19/75	0.6			1.3
07/02/75	0.6			0.3
07/06/75	0.3			0.2
07/10/75	2.0			8.0
07/13/75	0.8			3.7
07/16/75	0.1			0.0
07/17/75	0.5			0.2
07/20/75	0.4			0.2
07/24/75	2.2	<0.1	8.2	10.0
07/28/75	0.5			1.4
07/29/75	0.6			0.7
07/30/75	0.1			0.1
08/01/75	0.8			2.1
08/04/75	1.4			9.1
08/06/75	0.6			0.6
08/07/75	0.5			0.5
08/10/75	0.3			0.2
08/26/75	0.5			0.5
08/28/75	0.4			0.3
09/06/75	1.8			9.3
09/07/75	0.1			0.1
09/12/75	1.9			11.6
09/17/75	0.5			0.5
09/17/75	3.4			24.7
09/22/75	1.5			10.6
09/23/75	4.9	<0.1	3.5	25.5
09/23/75	0.8			2.3
10/01/75	0.8			0.9

TABLE C14. WATERSHED P4, CROPPING YEAR 1975

DATE	RAINFALL, CM	RUNOFF, CM	TOTAL SEDIMENT, KG/HA	EROSIVITY INDEX (W)
05/14/75	1.9			9.6
05/16/75	1.4			3.3
05/28/75	0.5			0.6
05/29/75	0.6			0.6
05/31/75	3.6	0.3	77.6	29.4
06/10/75	0.9			1.5
06/11/75	2.7	1.5	403.9	29.0
06/11/75	2.5	0.6	135.8	22.9
06/18/75	0.8			2.2
06/19/75	0.6			1.3
07/02/75	0.6			0.3
07/06/75	0.3			0.2
07/10/75	2.0			8.0
07/13/75	0.8			3.7
07/16/75	0.1			0.0
07/17/75	0.5			0.2
07/20/75	0.4			0.2
07/24/75	2.2			11.9
07/28/75	0.5			1.4
07/29/75	0.6			0.6
07/30/75	0.1			0.1
08/01/75	0.8			2.1
08/04/75	1.4			9.1
08/06/75	0.6			0.6
08/07/75	0.5			0.5
08/10/75	0.3			0.2
08/26/75	0.5			0.5
08/28/75	0.4			0.3
09/06/75	1.8			9.3
09/07/75	0.1			0.1
09/12/75	1.9			9.4
09/17/75	0.5			0.5
09/17/75	3.4	<0.1	4.5	24.7
09/22/75	1.5			10.6
09/23/75	4.9	1.0	59.1	25.5
09/23/75	0.8			2.3
10/01/75	0.8			0.9

TABLE C15. P1 WATERSHED SOIL-WATER CONTENT, 1972

Date	Water content cm^3/cm^3 at specified depth, cm						
	5	15	30	60	90	120	180
01 Jul*	0.140	0.202	0.218	0.387	0.370	0.346	-
25 Jul*	0.117	0.158	0.210	0.288†	0.291†	0.313†	0.282†
27 Jul	0.087	0.160	0.224	0.357	0.349	0.326	0.315
28 Jul	0.068	0.155	0.221	0.357	0.347(6)	0.324	0.313
02 Aug	0.131	0.196	0.244	0.355	0.354	0.327	0.314
04 Aug	0.083	0.166	0.247	0.357	0.357	0.309	0.314
10 Aug	0.092	0.135	0.203	0.343	0.351	0.324	0.317
14 Aug	0.097	0.159	0.218	0.337	0.353	0.322	0.311
18 Aug	0.056	0.136	0.200	0.316	0.339	0.320	0.309
23 Aug	0.048	0.122	0.175	0.294	0.326	0.315	0.309
28 Aug	0.087	0.136	0.175	0.297	0.318	0.306	0.309
01 Sep	0.048	0.123	0.170	0.288	0.300	0.296	0.306
06 Sep	0.135	0.186	0.190	0.291	0.301	0.289	0.301
15 Sep	0.048	0.122	0.170	0.288	0.291	0.270	0.293
22 Sep	0.048	0.123	0.170	0.288	0.291	0.256	0.289
02 Oct	0.075	0.127	0.170	0.288	0.290	0.260	0.281
24 Oct	0.074	0.117	0.170	0.288	0.298	0.257	0.273
01 Nov	0.116(6)	0.177	0.230	0.334	0.318	0.285	0.279

*From gravimetric measurement on soil samples at planting time and block installation with bulk density values applied as follows: 5 centimeters 1.40, 15 centimeters 1.65, 30 centimeters 1.49 to 1.65, 60 centimeters 1.50, 90 centimeters 1.50, 120 centimeters 1.62, and 180 centimeters 1.59 g/m^3.

†For some reason, these values are unreasonably low.

Note: All except dates indicated were derived from electrical resistance block measurements. Numbers in parenthesis indicates number of sample locations included in number. All other numbers from electrical resistance block measurements include seven locations.

TABLE C16. P1 WATERSHED SOIL-WATER CONTENT, 1973

Date	Water content cm^3/cm^3 at specified depth, cm							
	0.010	5	15	30	60	90	120	180
13 Jun*	0.010	0.181	0.211	0.300	0.332	0.323	0.348	0.311
02 Jul		0.154	0.189	0.249	0.359	0.341	0.322	0.296(6)
06 Jul		0.147	0.157(6)	0.243(6)	0.357	0.342	0.319	0.292(6)
09 Jul		0.202	0.202(6)	0.255(6)	0.360	0.341	0.321	0.291(6)
13 Jul		0.144	0.157(6)	0.237(6)	0.361	0.337	0.319	0.292(6)
18 Jul		0.191	0.163	0.223	0.355	0.342(6)	0.319	0.287(6)
27 Jul		0.134(6)	0.126(6)	0.201(6)	0.327(6)	0.344(5)	0.320(6)	0.302(4)
31 Jul		0.184(6)	0.154(6)	0.198(6)	0.324(6)	0.325(6)	0.302(6)	0.310(5)
08 Aug		0.177(6)	0.117(6)	0.188(6)	0.307(6)	0.316(6)	0.296(6)	0.294(6)
23 Aug		0.122(5)	0.128(6)	0.192(5)	0.304(6)	0.299(5)	0.276(5)	0.310(4)
31 Aug		0.117(5)	0.117(5)	0.179(5)	0.290(5)	0.288(4)	0.259(5)	0.307(4)
07 Sep		0.117(4)	0.117(4)	0.180(4)	0.289(4)	0.288(3)	0.255(5)	0.300(3)
11 Sep		0.176(3)	0.161(3)	0.228(5)	0.300(4)	0.288(3)	0.253(4)	0.298(2)
20 Sep		0.174(3)	0.176(3)	0.239(4)	0.304(4)	0.296(3)	0.260(4)	0.296(2)
05 Oct		0.148(3)	0.156(3)	0.208(4)	0.301(4)	0.298(3)	0.262(4)	0.295(2)
16 Oct		0.122(3)	0.127(3)	0.202(4)	0.304(4)	0.302(3)	0.259(4)	0.294(2)

*From gravimetric measurement on soil samples at planting time and block installation with bulk density values applied as follows: 5 centimeters 1.40, 15 centimeters 1.65, 30 centimeters 1.49 to 1.65, 60 centimeters 1.50, 90 centimeters 1.50, 120 centimeters 1.62, and 180 centimeters 1.59 g/m^3.

Note: All except dates indicated were derived from electrical resistance block measurements. Numbers in parenthesis indicates number of sample locations included in number. All other numbers from electrical resistance block measurements include seven locations.

TABLE C17. P1 WATERSHED SOIL-WATER CONTENT, 1974

Date	Water content cm^3/cm^3 at specified depth, cm							
	0.5	5	15	30	60	90	120	180
30 May*	0.052	0.109	0.207	0.264	0.319(3)	0.318(3)	0.301(2)	0.322(2)
17 Jun		0.158(2)	0.182(2)	0.231(3)	0.357(3)	0.340(3)	0.261(2)	0.296(2)
25 Jun		0.151(2)	0.188(2)	0.252(2)	0.355(2)	0.333(2)	0.260(2)	0.294(2)
28 Jun		0.176	0.207	0.237	0.354	0.363(6)	0.317	0.283
08 Jul		0.211	0.184	0.293	0.370	0.295(6)	0.311	0.286
12 Jul		0.123	0.145	0.223	0.348	0.349(6)	0.297	0.282
16 Jul		0.120	0.125	0.198	0.347	0.347(6)	0.298	0.285
24 Jul		0.130	0.117	0.186	0.318	0.338(6)	0.295	0.284
29 Jul		0.213	0.211	0.257	0.336	0.340(6)	0.294	0.284
01 Aug		0.135	0.160	0.220	0.332	0.331(6)	0.291	0.281
08 Aug		0.181	0.178	0.221	0.325	0.329(6)	0.279	0.283
15 Aug		0.214	0.179	0.231	0.337	0.331(6)	0.232	0.280
20 Aug		0.170	0.175	0.225	0.346	0.336(6)	0.284	0.275
23 Aug		0.152	0.171	0.231	0.297	0.338(6)	0.285	0.278
30 Aug		0.181	0.162	0.206	0.282	0.331(6)	0.282	0.274
04 Sep		0.181	0.162	0.209	0.330	0.337(6)	0.275	0.273
13 Sep		0.162	0.173	0.227	0.342	0.325	0.283	0.273
19 Sep		0.140	0.158	0.218	0.336	0.324	0.285	0.274
08 Oct		0.126	0.147	0.210	0.324	0.325(6)	0.279	0.261

*From gravimetric measurement on soil samples at planting time and block installation with bulk density values applied as follows: 0.5 centimeters 1.18, 5 centimeters 1.40, 15 centimeters 1.65, 30 centimeters 1.49 to 1.65, 60 centimeters 1.50, 90 centimeters 1.50, 1.20 centimeters 1.62, and 180 centimeters 1.59 g/m .

Note: All except dates indicated were derived from electrical resistance block measurements. Numbers in parenthesis indicates number of sample locations included in number All other numbers from electrical resistance block measurements include seven locations.

TABLE C18. P1 WATERSHED SOIL-WATER CONTENT, 1975

Depth, cm	Water content, g/g	Applied bulk density, g/cm	Water content cm^3/cm^3
0.5	0.142	1.50	0.212
5	0.129	1.65	0.213
15	0.131	1.65	0.216
30	0.184	1.49-1.65	0.288
60	0.222	1.50	0.334
90	0.232	1.50	0.349
120	0.218	1.59-1.62	0.351
180	0.199	1.59	0.316

Note: Each water content at 0.5, 5, 15, and 30 centimeters depth is the mean of 14 samples from 14 locations. Water content values for 60, 90, 120, and 180 centimeter depths are means of samples at three locations.

TABLE C19. P3 WATERSHED SOIL-WATER CONTENT, 1972

Date	Water content cm^3/cm^3 at specified depth, cm						
	5	15	30	60	90	120	180
01 Jul*	0.130	0.185	0.265	0.367	0.377	0.378	-
19 Jul*	0.103	0.176	0.234	0.349	0.360	0.340	0.321
24 Jul	0.119	0.146	0.305	0.397	0.391	0.340	0.330
02 Aug	0.258	0.301	0.348	0.395	0.368	0.322	0.322
04 Aug	0.151	0.195	0.315	0.380	0.358	0.324	0.332
10 Aug	0.253	0.165	0.271	0.385	0.374	0.345	0.317
14 Aug	0.250	0.165	0.272	0.344	0.365	0.328	0.327
18 Aug	0.119	0.122	0.258	0.323	0.349	0.314	0.315
23 Aug	0.117	0.118	0.245	0.300	0.324	0.304	0.318
28 Aug	0.118	0.117	0.242	0.295	0.309	0.276	0.304
01 Sep	0.117	0.117	0.242	0.292	0.299	0.263	0.308
06 Sep	0.213	0.234	0.279	0.294	0.303	0.268	0.298
15 Sep	0.117	0.117	0.242	0.290	0.292	0.233	0.292
22 Sep	0.117	0.117	0.242	0.288	0.290	0.224	0.275
							0.271
02 Oct	0.160	0.146	0.250	0.288	0.289	0.235	0.271
04 Oct	0.142	0.119	0.242	0.288	0.297	0.256	0.276
09 Nov	0.178	0.182	0.309	0.319	0.319	0.274	0.279

*From gravimetric determination on soil samples.

Note: 5 centimeter and 30 centimeter value is from curve.
15 centimeter value is mean of 11 and 19 centimeter values.

TABLE C20. P3 WATERSHED SOIL-WATER CONTENT, 1973

Date	Water content cm^3/cm^3 at specified depth, cm						
	5	15	30	60	90	120	180
15 Jun*	0.166	0.217	0.318	0.400	0.388	0.393	0.328
02 Jul	0.162	0.194	0.324	0.361	0.347	0.291	0.294
06 Jul	0.149	0.169	0.319	0.359	0.346	0.295	0.293
09 Jul	0.204	0.204	0.324	0.360	0.350	0.302	0.296
13 Jul	0.152	0.177	0.305	0.354	0.346	0.285	0.298
16 Jul	0.180	0.176	0.304	0.357	0.346	0.295	0.296
27 Jul	0.193	0.177	0.285	0.341	0.340	0.293	0.294
08 Aug	0.117	0.120	0.246	0.298	0.303	0.277	0.285
23 Aug	0.117	0.119	0.242	0.290	0.290	0.247	0.266
31 Aug	0.117	0.118	0.242	0.288	0.288	0.230	0.255
07 Sep	0.117	0.118	0.242	0.288	0.288	0.226	0.239
11 Sep	0.201	0.192	0.303	0.289	0.290	0.228	0.247
20 Sep	0.181	0.200	0.320	0.313	0.297	0.227	0.251
05 Oct	0.159	0.161	0.285	0.303	0.297	0.241	0.260
16 Oct	0.117	0.119	0.254	0.298	0.298	0.242	0.266

*Planting date---values represent one sample.

Note: All values 02 July and after are from electrical resistance block measurement representing mean of five to six values.

TABLE C21. P3 WATERSHED SOIL-WATER CONTENT, 1974

Date	Water content cm^3/cm^3 at specified depth, cm						
	5	15	30	60	90	120	180
30 May*	0.118	0.209	0.269	0.336	0.304	0.313	0.319
21 Jun	0.239	0.173	0.327	0.349	0.325	0.253	0.250
28 Jun	0.190	0.202	0.333	0.344	0.337	0.289	0.267
08 Jul	0.163	0.195	0.324	0.344	0.323	0.240	0.246
12 Jul	0.141	0.168	0.312	0.346	0.322	0.249	0.252
16 Jul	0.132	0.144	0.282	0.337	0.320	0.230	0.251
24 Jul	0.134	0.132	0.263	0.318	0.322	0.238	0.250
29 Jul	0.199	0.182	0.312	0.340	0.319	0.268	0.244
01 Aug	0.168	0.189	0.312	0.341	0.321	0.221	0.250
08 Aug	0.181	0.175	0.309	0.340	0.322	0.230	0.250
15 Aug	0.196	0.177	0.308	0.339	0.316	0.242	0.244
20 Aug	0.172	0.173	0.309	0.338	0.317	0.244	0.251
23 Aug	0.155	0.168	0.308	0.338	0.318	0.237	0.249
30 Aug	0.173	0.163	0.289	0.329	0.314	0.235	0.247
	0						
04 Sep	0.175	0.166	0.293	0.328	0.312	0.237	0.248
13 Sep	0.161	0.170	0.308	0.330	0.316	0.245	0.248
19 Sep	0.146	0.159	0.302	0.332	0.315	0.235	0.248
08 Oct	0.125	0.135	0.283	0.327	0.315	0.242	0.248

*Planting date---means of one to three samples; by gravimetric determination.

Note: Beginning on 21 June, values are means of four to six electrical resistance block readings.

TABLE C22. P2 WATERSHED SOIL-WATER CONTENT, PLANTING DATE 11 MAY 1973

Position†	Water content,* g/g at depth, cm							
	0.5	5	15	30	60	90	120	180
3	-	-	-	-	0.2859	0.2943	0.2528	0.2264
5	0.0168	0.1516	0.1887	0.1688	0.1865	0.2375	0.2707	0.2191
7	0.0205	0.1876	0.2241	0.2255	0.1998	0.2398	0.2702	0.2338
9	0.0197	0.1048	0.1666	0.1553	0.1931	0.1950	0.1763	0.2368
16-17	0.0467	0.1392	0.1540	0.1891	0.2741	0.2115	0.2122	0.1884
19	0.0108	0.0993	0.1217	0.2542	0.2159	0.2214	0.2256	0.2105
20-21	0.0266	0.1067	0.1377	0.2705	0.2920	0.2192	0.2217	0.2289
28-29	0.0080	0.1190	0.1332	0.2806	0.2540	0.2403	0.2480	0.2079
31	0.0054	0.0886	0.1057	0.1779	0.2400	0.2222	0.1942	0.2309
41	0.0084	0.0969	0.1210	0.1232	0.2642	0.2596	0.2412	0.1760
42	0.0070	0.0949	0.1312	0.1896	0.2053	0.2291	0.1786	0.1999
49	0.0077	0.1298	0.1480	0.2558	0.2335	0.1984	0.1439	0.2352
Mean, g/g	0.016	0.120	0.148	0.208	0.237	0.231	0.220	0.216
Mean, cm^3/cm^3	0.019	0.168	0.245	0.310	0.356	0.346	0.356	0.344
Bulk density, g/cm^3	1.18	1.40	1.65	1.49	1.50	1.50	1.62	1.59

*Determined gravimetrically

†According to grid points on watershed map.

TABLE C23. P2 WATERSHED SOIL-WATER CONTENT, PLANTING DATE 29 APRIL 1974

Position†	Water content,* g/g at depth, cm			
	0.5	5	15	30
3	0.007	0.083	0.137	0.210
5	0.008	0.059	0.171	0.153
7	0.016	0.129	0.199	0.197
9	0.006	0.069	0.120	0.167
16-17	0.011	-	0.174	0.223
19	0.005	0.050	0.080	0.084
20-21	0.005	0.040	0.113	0.247
28-29	0.005	0.043	0.112	0.218
31	0.004	0.059	0.101	0.181
39	0.004	0.051	0.125	0.244
41	0.004	0.052	0.098	0.129
42	0.004	0.046	0.105	0.213
49	0.006	0.032	0.135	0.235
Mean, g/g	0.006	0.059	0.128	0.192
Mean, cm^3/cm^3	0.007	0.083	0.211	0.287
Bulk density, g/cm^3	1.180	1.400	1.650	1.490

*Determined gravimetrically.

†According to grid points on watershed map.

TABLE C24. P2 WATERSHED SOIL-WATER CONTENT, 19 APRIL 1974

Position†	Water content,* g/g at depth, cm							
	0-8	8-15	15-30	30-46	46-61	61-91	91-122	122-152
3	0.039	0.071	0.111	0.270	0.146	0.198	0.286	0.258
5	0.204	0.188	0.202	0.170	0.193	0.306	0.194	0.238
7	0.179	0.205	0.215	0.189	0.196	0.215	0.192	0.186
9	0.152	0.105	0.432	0.149	0.186	0.204	0.197	0.163
16-17	0.144	0.128	0.230	0.286	0.244	0.169	0.239	0.214
18-19	0.132	0.099	0.171	0.248	0.194	0.237	0.218	0.186
20	0.061	0.088	0.169	0.273	0.256	0.279	0.241	0.239
28-29	0.128	0.122	0.129	0.282	0.314	0.282	0.188	0.240
30-31	0.081	0.088	0.123	0.236	0.242	0.170	0.227	0.219
32	0.091	0.107	0.121	0.174	0.180	0.225	0.229	0.222
39-40	0.074	0.105	0.199	0.258	0.275	0.226	0.226	0.166
41-42	0.106	0.136	0.295	0.192	0.271	0.226	0.211	0.208
49-50	0.072	0.088	0.193	0.237	0.305	0.196	0.193	0.204
51	0.114	0.069	0.172	0.576	0.259	0.276	0.209	0.188
57	0.091	0.155	0.172	0.576	0.220	0.218	0.189	0.163
Average	0.111	0.117	0.196	0.274	0.232	0.228	0.214	0.206

*Determined gravimetrically.

†According to grid points on watershed map.

TABLE C25. P2 WATERSHED SOIL-WATER CONTENT, 5 JUNE 1974

Position†	Water content,* g/g at depth, cm							
	0-8	8-15	15-30	30-46	46-61	61-91	91-122	122-152
3	0.085	0.086	0.103	0.111	0.133	0.186	0.249	0.228
5	0.143	0.178	0.203	0.174	0.255	0.268	0.237	0.300
7	0.163	0.185	0.179	0.173	0.169	0.204	0.275	0.293
9	0.095	0.114	0.132	0.155	0.169	0.182	0.176	0.152
16-17	0.115	0.123	0.210	0.256	0.239	0.244	0.219	0.226
18-19	0.071	0.075	0.157	0.222	0.238	0.228	0.192	0.195
20	0.101	0.097	0.225	0.271	0.320	0.232	0.231	0.248
28-29	0.076	0.106	0.148	0.195	0.268	0.270	0.228	0.235
31	0.058	0.079	0.144	0.230	0.235	0.211	0.188	0.224
32	0.059	0.088	0.208	0.262	0.219	0.253	0.193	0.189
39-40	0.076	0.108	0.186	0.254	0.252	0.226	0.176	0.196
41-42	0.074	0.120	0.131	0.202	0.289	0.244	0.230	0.215
49-50	0.086	0.131	0.158	0.249	0.238	0.234	0.220	0.180
51	0.085	0.102	0.111	0.242	0.248	0.267	0.787	0.174
57	0.068	0.083	0.200	0.258	0.220	0.238	0.187	0.188
Average	0.091	0.112	0.166	0.217	0.233	0.232	0.253	0.216

*Determined gravimetrically.

†According to grid points on watershed map.

TABLE C26. P2 WATERSHED SOIL-WATER CONTENT, 8 JULY 1974

Position†	Water content,* g/g at depth, cm							
	0-8	8-15	15-30	30-46	46-61	61-91	91-122	122-152
3	0.043	0.059	0.058	0.080	0.121	0.168	0.213	0.211
5	0.135	0.178	0.172	0.194	0.223	0.266	0.248	0.184
7	0.200	0.130	0.169	0.190	0.190	0.179	0.192	0.202
9	0.084	0.087	0.119	0.113	0.136	0.216	0.224	0.191
16-17	0.029	0.054	0.087	0.179	0.240	0.144	0.157	0.168
18-19	0.034	0.058	0.117	0.180	0.204	0.185	0.181	0.174
20	0.051	0.063	0.156	0.229	0.233	0.208	0.217	0.209
28-29	0.037	0.058	0.114	0.166	0.227	0.237	0.232	0.231
30-31	0.044	0.051	0.075	0.145	0.211	0.212	0.209	0.171
32	0.035	0.041	0.192	0.220	0.248	0.190	0.177	0.173
39-40	0.040	0.059	0.120	0.199	0.217	0.214	0.177	0.172
41-42	0.069	0.087	0.109	0.175	0.204	0.225	0.204	0.203
49-50	0.038	0.055	0.085	0.209	0.215	0.218	0.170	0.173
51	0.073	0.081	0.125	0.259	0.254	0.198	0.187	0.197
57	0.039	0.072	0.144	0.240	0.240	0.219	0.223	0.230
Average	0.063	0.076	0.123	0.185	0.211	0.205	0.201	0.193

*Determined gravimetrically.

†According to grid points on watershed map.

TABLE C27. P2 WATERSHED SOIL-WATER CONTENT, 30 OCTOBER 1974

Position†	Water content,* g/g at depth, cm							
	0-8	8-15	15-30	30-46	46-61	61-91	91-122	122-152
3	0.047	0.058	0.063	0.096	0.115	0.168	0.206	0.175
5	0.111	0.125	0.137	0.121	0.153	0.247	0.185	0.221
7	0.085	0.127	0.141	0.147	0.159	0.149	0.169	0.194
9	0.079	0.110	0.099	0.131	0.156	0.167	0.144	0.150
16-17	0.067	0.082	0.147	0.239	0.240	0.236	0.198	0.193
18-19	0.047	0.052	0.130	0.195	0.217	0.220	0.159	0.150
20	0.065	0.069	0.191	0.212	0.243	0.211	0.198	0.211
28-29	0.053	0.065	0.115	0.187	0.228	0.229	0.201	0.207
30-31	0.052	0.056	0.097	0.210	0.207	0.199	0.212	0.238
32	0.032	0.052	0.162	0.209	0.209	0.206	0.187	0.181
39-40	0.106	0.073	0.091	0.221	0.228	0.189	0.194	0.201
41-42	0.070	0.072	0.103	0.130	0.199	0.234	0.215	0.203
49-50	0.049	0.059	0.117	0.197	0.163	0.204	0.173	0.175
51	0.072	0.069	0.103	0.147	0.260	0.202	0.158	0.158
57	0.055	0.067	0.087	0.209	0.259	0.232	0.201	0.217
Average	0.066	0.076	0.119	0.177	0.202	0.206	0.197	0.191

*Determined gravimetrically.

†According to grid points on watershed map.

TABLE C28. P2 WATERSHED SOIL-WATER CONTENT, 22 APRIL 1975

Position†	Water content,* g/g at depth, cm							
	0-8	8-15	15-30	30-46	46-61	61-91	91-122	122-152
3	0.079	0.098	0.106	0.139	0.163	0.222	0.250	0.229
5	0.182	0.178	0.220	0.184	0.233	0.213	0.261	0.226
7	0.162	0.148	0.190	0.162	0.159	0.202	0.174	0.179
9	0.105	0.118	0.148	0.163	0.175	0.175	0.141	0.184
16-17	0.105	0.115	0.205	0.212	0.242	0.169	0.205	0.240
18-19	0.072	0.088	0.138	0.269	0.254	0.245	0.211	0.209
20	0.044	0.100	0.251	0.168	0.262	0.143	0.223	0.197
28-29	0.110	0.087	0.135	0.206	0.233	0.259	0.280	0.242
30-31	0.081	0.084	0.124	0.232	0.251	0.247	0.257	0.254
32	0.118	0.120	0.197	0.317	0.280	0.262	0.219	0.223
39-40	0.090	0.115	0.155	0.239	0.279	0.219	0.210	0.217
41-42	0.104	0.111	0.131	0.162	0.209	0.247	0.228	0.189
49-50	0.066	0.094	0.102	0.169	0.264	0.279	0.230	0.208
51	0.075	0.094	0.126	0.221	0.271	0.228	0.202	0.190
57	0.071	0.096	0.116	0.193	0.259	0.273	0.228	0.172
Average	0.098	0.110	0.156	0.202	0.236	0.226	0.221	0.211

*Determined gravimetrically.

†According to grid points on watershed map.

TABLE C29. P2 WATERSHED SOIL-WATER CONTENT, PLANTING DATE 21 MAY 1975

Position†	Water content,* g/g at depth, cm							
	0.5	5	14-26	29-54	56-84	86-114	116-144	176-184
3	0.036	0.114	0.113	0.134	0.149	0.203	0.268	0.265
5	0.051	0.171	0.201	0.167	0.137	0.230	0.284	0.200
7	0.072	0.188	0.211	0.192	0.209	0.251	0.270	0.314
9	0.026	0.118	0.148	0.196	0.229	0.240	0.168	0.240
16-17	0.014	0.127	0.157	0.261	0.253	0.206	0.173	0.191
18-19	0.005	0.097	0.113	0.163	0.266	0.202	0.214	0.209
20	0.007	0.105	0.124	0.296	0.334	0.268	0.221	0.199
28-29	0.007	0.083	0.144	0.224	0.300	0.224	0.221	0.236
30-31	0.006	0.086	0.149	0.277	0.243	0.300	0.211	0.217
32	0.006	0.085	0.123	0.265	0.282	0.228	0.230	0.234
39-40	0.005	0.079	0.133	0.274	0.318	0.196	0.188	0.211
41-42	0.010	0.102	0.130	0.262	0.239	0.228	0.204	0.244
49-50	0.006	0.074	0.116	0.257	0.325	0.206	0.164	0.172
51	0.018	0.101	0.137	0.256	0.210	0.227	0.208	0.182
53-57	0.005	0.069	0.103	0.140	0.286	0.232	0.212	0.249
Mean, g/g	0.018	0.107	0.140	0.224	0.252	0.229	0.216	0.223
Mean, cm^3/cm^3	0.022	0.149	0.231	0.334	0.378	0.244	0.350	0.354
Bulk density, g/cm^3	1.18	1.40	1.65	1.49	1.50	1.50	1.62	1.59

*Determined gravimetrically.

†According to grid points on watershed map.

TABLE C30. P2 WATERSHED SOIL-WATER CONTENT, 20 MAY 1975

Position†	Water content,* g/g at depth, cm							
	0-8	8-15	15-30	30-46	46-61	61-91	91-122	122-152
3	0.090	0.102	0.109	0.131	0.020	0.020	0.020	0.020
5	0.159	0.169	0.194	0.148	0.185	0.239	0.214	0.287
7	0.131	0.171	0.192	0.176	0.170	0.201	0.280	0.276
9	0.103	0.132	0.149	0.156	0.171	0.173	0.173	0.158
16-17	0.095	0.101	0.175	0.250	0.237	0.195	0.189	0.199
18-19	0.073	0.079	0.173	0.226	0.222	0.220	0.208	0.167
20	0.077	0.091	0.177	0.232	0.295	0.267	0.234	0.254
28-29	0.090	0.103	0.155	0.209	0.229	0.265	0.211	0.186
30-31	0.090	0.091	0.148	0.244	0.269	0.218	0.231	0.245
32	0.085	0.097	0.224	0.264	0.273	0.265	0.191	0.195
39-40	0.079	0.100	0.154	0.263	0.260	0.234	0.215	0.230
41-42	0.096	0.112	0.133	0.192	0.248	0.246	0.200	0.199
49-50	0.077	0.111	0.140	0.202	0.219	0.215	0.191	0.206
51	0.090	0.106	0.114	0.234	0.272	0.218	0.182	0.386
57	0.078	0.115	0.141	0.181	0.261	0.209	0.201	0.136
Average	0.094	0.112	0.159	0.207	0.222	0.212	0.196	0.222

*Determined gravimetrically.

†According to grid points on watershed map.

TABLE C31. P2 WATERSHED SOIL-WATER CONTENT, 10 JUNE 1975

Position†	Water content,* g/g at depth, cm							
	0-8	8-15	15-30	30-46	46-61	61-91	91-122	122-152
3	0.098	0.093	0.108	0.122	0.151	0.189	0.261	0.282
5	0.153	0.177	0.194	0.136	0.183	0.237	0.223	0.236
7	0.154	0.182	0.160	0.188	0.198	0.206	0.209	0.237
9	0.077	0.142	0.149	0.178	0.176	0.223	0.214	0.186
16-17	0.113	0.133	0.176	0.228	0.261	0.179	0.185	0.164
18-19	0.091	0.091	0.131	0.230	0.252	0.232	0.201	0.211
20	0.091	0.120	0.169	0.288	0.267	0.227	0.218	0.209
28-29	0.067	0.099	0.100	0.217	0.268	0.282	0.243	0.261
30-31	0.086	0.091	0.117	0.234	0.237	0.239	0.244	0.227
32	0.098	0.089	0.196	0.278	0.278	0.292	0.217	0.207
39-40	0.075	0.131	0.165	0.246	0.284	0.238	0.223	0.231
41-42	0.102	0.116	0.131	0.107	0.236	0.220	0.197	0.212
49-50	0.085	0.125	0.172	0.209	0.228	0.250	0.206	0.193
51	0.114	0.094	0.125	0.190	0.204	0.181	0.199	0.157
57	0.084	0.108	0.098	0.241	0.227	0.226	0.199	0.202
Average	0.099	0.119	0.146	0.206	0.230	0.228	0.216	0.214

*Determined gravimetrically.

†According to grid points on watershed map.

TABLE C32. P2 WATERSHED SOIL-WATER CONTENT, 23 JUNE 1975

Position†	Water content,* g/g at depth, cm							
	0-8	8-15	15-30	30-46	46-61	61-91	91-122	122-152
3	0.070	0.092	0.087	0.119	0.140	0.212	0.230	0.224
5	0.129	0.165	0.157	0.157	0.200	0.249	0.271	0.224
7	0.138	0.175	0.211	0.182	0.183	0.196	0.237	0.288
9	0.304	0.131	0.123	0.132	0.151	0.191	0.183	0.171
16-17	0.118	0.119	0.170	0.225	0.251	0.201	0.207	0.236
18-19	0.074	0.080	0.102	0.222	0.242	0.226	0.225	0.225
20	0.088	0.101	0.252	0.259	0.243	0.212	0.254	0.261
28-29	0.077	0.097	0.088	0.177	0.232	0.268	0.257	0.238
30-31	0.176	0.060	0.099	0.190	0.242	0.226	0.215	0.238
32	0.085	0.090	0.151	0.267	0.278	0.268	0.231	0.211
39-40	0.080	0.101	0.115	0.195	0.252	0.210	0.198	0.213
41-42	0.078	0.093	0.114	0.169	0.242	0.241	0.204	0.182
49-50	0.073	0.093	0.142	0.204	0.266	0.216	0.210	0.210
51	0.064	0.083	0.108	0.194	0.237	0.212	0.190	0.180
57	0.090	0.097	0.115	0.162	0.217	0.245	0.210	0.213
Average	0.111	0.105	0.136	0.190	0.225	0.225	0.221	0.221

*Determined gravimetrically.

†According to grid points on watershed map.

TABLE C33. P2 WATERSHED SOIL-WATER CONTENT, 21 JULY 1975

Position†	Water content,* g/g at depth, cm							
	0-8	8-15	15-30	30-46	46-61	61-91	91-122	122-152
3	0.058	0.058	0.062	0.086	0.139	0.208	0.192	0.191
5	0.055	0.063	0.045	0.085	0.197	0.233	0.185	0.205
7	0.146	0.171	0.183	0.174	0.156	0.156	0.202	0.163
9	0.143	0.157	0.162	0.170	0.215	0.206	0.188	0.174
16-17	0.075	0.088	0.148	0.199	0.219	0.211	0.196	0.192
18-19	0.049	0.059	0.128	0.200	0.211	0.209	0.195	0.206
20	0.059	0.059	0.191	0.247	0.209	0.219	0.244	0.226
28-29	0.059	0.058	0.073	0.135	0.157	0.223	0.202	0.210
30-31	0.050	0.053	0.063	0.133	0.207	0.193	0.200	0.218
32	0.058	0.048	0.098	0.203	0.258	0.235	0.207	0.197
39-40	0.097	0.111	0.125	0.200	0.208	0.222	0.211	0.223
41-42	0.110	0.131	0.130	0.109	0.135	0.211	0.204	0.208
49-50	0.052	0.055	0.118	0.256	0.223	0.203	0.194	0.201
51	0.054	0.055	0.069	0.131	0.196	0.189	0.173	0.146
57	0.073	0.084	0.192	0.225	0.227	0.222	0.233	0.225
Average	0.107	0.112	0.147	0.206	0.225	0.223	0.220	0.214

*Determined gravimetrically.

†According to grid points on watershed map.

TABLE C34. P2 WATERSHED SOIL-WATER CONTENT, 30 OCTOBER 1975

Position†	Water content,* g/g at depth, cm							
	0-8	8-15	15-30	30-46	46-61	61-91	91-122	122-152
3	0.081	0.069	0.081	0.086	0.106	0.129	0.257	0.278
5	0.205	0.194	0.174	0.122	0.131	0.165	0.237	0.229
7	0.179	0.182	0.187	0.174	0.160	0.254	0.273	0.231
9	0.098	0.097	0.117	0.121	0.168	0.168	0.182	0.176
16-17	0.106	0.127	0.170	0.268	0.290	0.248	0.180	0.211
18-19	0.085	0.096	0.120	0.227	0.247	0.230	0.216	0.226
20	0.065	0.088	0.209	0.286	0.324	0.229	0.234	0.268
28-29	0.089	0.095	0.115	0.231	0.273	0.261	0.248	0.176
30-31	0.088	0.097	0.114	0.209	0.249	0.260	0.234	0.219
32	0.103	0.106	0.189	0.250	0.266	0.271	0.210	0.210
39-40	0.088	0.106	0.166	0.263	0.275	0.223	0.209	0.189
41-42	0.133	0.125	0.134	0.162	0.197	0.238	0.214	0.219
49-50	0.100	0.095	0.168	0.251	0.251	0.235	0.200	0.196
51	0.108	0.111	0.112	0.207	0.229	0.209	0.197	0.171
57	0.077	0.097	0.150	0.241	0.210	0.218	0.209	0.216
Average	0.107	0.112	0.147	0.206	0.225	0.223	0.220	0.214

*Determined gravimetrically.

†According to grid points on watershed map.

TABLE C35. P4 WATERSHED SOIL-WATER CONTENT, 1974 AND 1975 GROWING SEASONS

Date	Water content,* g/g at depth, cm							
	0-8	8-15	15-30	30-46	46-61	61-91	91-122	122-152
19 Apr 74	0.114	0.131	0.201	0.247	0.243	0.243	0.217	0.225
21 May 74	0.104	0.118	0.167	0.203	0.211	0.222	0.207	0.210
06 Jun 74	0.096	0.115	0.161	0.208	0.225	0.226	0.209	0.211
08 Jul 74	0.075	0.111	0.179	0.217	0.215	0.217	0.197	0.206
30 Oct 74	0.074	0.089	0.148	0.203	0.203	0.207	0.200	0.200
22 Apr 75	0.102	0.124	0.171	0.217	0.234	0.230	0.206	0.212
10 Jun 75	0.093	0.117	0.159	0.211	0.220	0.221	0.211	0.210
23 Jun 75	0.117	0.128	0.173	0.217	0.243	0.235	0.214	0.203
21 Jul 75	0.105	0.097	0.121	0.162	0.172	0.199	0.196	0.190
30 Oct 75	0.096	0.121	0.184	0.222	0.235	0.216	0.215	0.215

*Determined gravimetrically.

TABLE C36. DAILY EVAPORATION RATES, 1972
cm/day*

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	----	----	----	----	----	----	0.762	0.010	0.574	0.475	0.234	0.043
2	----	----	----	----	----	----	0.876	0.389	0.523	0.284	0.008	0.127
3	----	----	----	----	----	----	0.937	0.610	0.556	0.493	0.030	0.127
4	----	----	----	----	----	----	0.358	0.688	0.584	0.269	0.330	0.183
5	----	----	----	----	----	----	0.358	0.759	0.262	0.241	0.330	0.165
6	----	----	----	----	----	----	0.518	0.627	0.544	0.241	0.363	0.091
7	----	----	----	----	----	----	0.518	0.645	0.574	0.673	0.452	0.094
8	----	----	----	----	----	----	0.500	0.683	0.320	0.465	0.300	0.069
9	----	----	----	----	----	----	0.508	0.838	0.528	0.490	0.343	0.020
10	----	----	----	----	----	----	0.447	0.602	0.691	0.384	0.122	0.020
11	----	----	----	----	----	----	0.627	0.457	0.340	0.554	0.216	0.025
12	----	----	----	----	----	----	0.635	0.511	0.417	0.325	0.216	0.051
13	----	----	----	----	----	----	0.528	0.274	0.737	0.269	0.244	0.302
14	----	----	----	----	----	----	0.612	0.312	0.381	0.320	0.201	0.409
15	----	----	----	----	----	----	0.566	0.551	0.569	0.284	0.411	0.074
16	----	----	----	----	----	----	0.665	0.406	0.701	0.300	0.290	0.178
17	----	----	----	----	----	----	0.775	0.361	0.391	0.312	0.122	0.178
18	----	----	----	----	----	----	0.239	0.310	0.188	0.358	0.444	0.198
19	----	----	----	----	----	----	0.544	0.632	0.340	0.254	0.444	0.114
20	----	----	----	----	----	----	0.328	0.561	0.564	0.607	0.526	0.079
21	----	----	----	----	----	----	0.975	0.450	0.767	0.640	0.224	0.127
22	----	----	----	----	----	----	0.754	0.612	0.409	0.145	0.086	0.127
23	----	----	----	----	----	----	0.698	0.495	0.556	0.719	0.076	0.381
24	----	----	----	----	----	----	0.599	0.234	0.508	0.531	0.076	0.152
25	----	----	----	----	----	----	0.384	0.414	0.320	0.302	0.076	0.206
26	----	----	----	----	----	----	0.505	0.277	0.152	0.140	0.076	0.079
27	----	----	----	----	----	----	0.503	0.551	0.323	0.335	0.084	0.254
28	----	----	----	----	----	----	0.396	0.450	0.742	0.747	0.302	0.508
29	----	----	----	----	----	----	1.052	0.483	0.213	0.254	0.018	0.175
30	----	----	----	----	----	----	0.028	0.551	0.378	0.185	0.170	0.206
31	----	----	----	----	----	----	0.846	0.597	----	0.145	----	0.302

* -- SOME VALUES ARE AVERAGED OVER SEVERAL DAYS

TABLE C37. DAILY EVAPORATION RATES, 1973
cm/day*

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.084	0.297	0.206	0.104	0.043	0.980	0.467	0.323	0.074	0.152	0.381	0.330
2	0.084	0.363	0.582	0.104	0.452	0.178	0.584	0.297	0.244	0.254	0.305	0.330
3	0.084	0.241	0.147	0.109	0.584	0.178	0.500	0.168	0.726	0.356	0.203	0.229
4	0.0	0.246	0.147	0.218	0.013	0.218	0.559	0.508	0.478	0.381	0.203	0.254
5	0.165	0.246	0.147	0.406	0.676	0.564	0.518	0.361	0.442	0.432	0.483	0.229
6	0.132	0.330	0.244	0.053	0.330	0.025	0.663	0.381	0.091	0.508	0.229	0.203
7	0.132	0.488	0.013	0.053	0.333	0.239	0.564	0.203	0.617	0.457	0.051	0.152
8	0.132	0.277	0.140	0.053	0.241	0.231	0.869	0.330	0.508	0.330	0.0	0.279
9	0.132	0.028	0.119	0.053	0.450	0.124	0.224	0.409	0.737	0.432	0.330	0.178
10	0.132	0.081	0.069	0.053	0.701	0.744	0.660	0.114	0.508	0.584	0.305	0.051
11	0.132	0.084	0.069	0.058	0.676	0.224	0.625	0.437	0.559	0.279	0.254	0.279
12	0.132	0.084	0.071	0.058	0.711	0.470	0.475	0.508	0.610	0.127	0.203	0.178
13	0.132	0.063	0.422	0.409	0.485	0.437	0.663	0.013	0.254	0.406	0.203	0.279
14	0.132	0.221	0.422	0.409	0.587	0.297	0.551	0.226	0.559	0.432	0.229	0.178
15	0.127	0.185	0.452	0.409	0.643	0.516	0.879	0.653	0.610	0.279	0.102	0.178
16	0.155	0.190	0.353	0.409	0.742	0.399	0.500	0.361	0.483	0.305	0.102	0.508
17	0.089	0.180	0.208	0.003	0.572	0.528	0.317	0.386	0.279	0.330	0.254	0.356
18	0.193	0.180	0.208	0.320	0.579	0.582	0.206	0.295	0.432	0.406	0.508	0.229
19	0.193	0.185	0.208	0.320	0.531	0.470	0.287	0.226	0.635	0.305	0.279	0.279
20	0.254	0.185	0.208	0.320	0.241	0.531	0.140	0.406	0.432	0.381	0.102	0.356
21	0.254	0.328	0.384	0.320	0.343	0.277	0.599	0.643	0.432	0.305	0.203	0.508
22	0.259	0.335	0.150	0.320	0.787	0.493	0.462	0.559	0.432	0.305	0.152	0.533
23	0.554	0.406	0.356	0.320	0.386	0.605	0.488	0.447	0.406	0.305	0.279	0.483
24	0.150	0.180	0.300	0.048	0.775	0.203	0.503	0.381	0.381	0.282	0.152	0.406
25	0.112	0.185	0.300	0.048	0.511	0.864	0.254	0.351	0.483	0.262	0.127	0.051
26	0.112	0.185	0.300	0.069	0.381	0.361	0.234	0.427	0.483	0.239	0.203	0.203
27	0.112	0.112	0.246	1.204	0.300	0.417	0.351	0.163	0.203	0.216	0.102	0.330
28	0.117	0.241	0.295	0.211	0.508	0.193	0.152	0.533	0.051	0.196	0.330	0.178
29	0.117	----	0.173	0.211	0.010	0.325	0.528	0.117	0.330	0.178	0.229	0.076
30	0.427	----	0.107	0.211	0.511	0.701	0.554	0.782	0.406	0.254	0.864	0.229
31	0.079	----	0.107	----	0.660	----	0.368	0.373	----	0.051	----	0.330

* -- SOME VALUES ARE AVERAGED OVER SEVERAL DAYS

TABLE C38. DAILY EVAPORATION RATES, 1974
cm/day*

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.432	0.305	0.432	0.356	0.0	0.478	0.737	0.264	0.681	0.452	0.284	0.284
2	0.406	0.279	0.483	0.305	0.528	0.112	0.429	0.566	0.597	0.406	0.282	0.284
3	0.406	0.356	0.432	0.914	0.589	0.127	0.777	0.323	0.221	0.406	0.284	0.284
4	0.076	0.279	0.381	0.635	0.673	0.782	0.368	0.218	0.658	0.406	0.282	0.183
5	0.025	0.635	0.508	0.787	0.317	0.650	0.643	0.356	0.503	0.406	0.284	0.185
6	0.432	0.533	0.025	0.635	0.074	0.518	0.102	0.549	0.003	0.406	0.224	0.183
7	0.508	0.381	0.0	0.914	0.566	0.239	0.302	0.582	1.435	0.406	0.224	0.185
8	0.203	0.330	0.533	0.686	0.396	0.119	0.429	0.117	0.124	0.406	0.224	0.183
9	0.051	0.279	0.381	0.711	0.246	0.462	0.340	0.152	0.132	0.272	0.224	0.185
10	0.025	0.381	0.432	0.483	0.549	0.671	0.752	0.427	0.241	0.272	0.224	0.183
11	0.203	0.533	0.406	0.508	0.480	0.150	0.775	0.668	0.323	0.272	0.224	0.185
12	0.406	0.203	0.508	0.508	0.564	1.072	0.536	0.239	0.483	0.272	0.224	0.351
13	0.381	0.203	0.457	0.584	0.665	0.665	0.541	0.190	0.386	0.272	0.224	0.351
14	0.406	0.381	0.584	0.533	0.635	0.516	0.274	0.376	0.353	0.272	0.089	0.351
15	0.279	0.279	0.584	0.635	0.686	0.236	0.305	0.528	0.099	0.272	0.089	0.351
16	0.102	0.279	0.483	0.025	0.142	0.859	0.338	2.009	0.376	0.157	0.089	0.351
17	0.203	0.076	0.356	0.051	0.625	0.897	0.704	0.351	0.254	0.157	0.089	0.351
18	0.127	0.203	0.305	0.508	0.183	0.683	0.203	0.452	0.175	0.157	0.089	0.351
19	0.178	0.508	0.483	0.356	0.904	0.556	0.594	0.701	0.452	0.157	0.089	0.615
20	0.102	0.279	0.279	0.508	0.485	0.363	0.478	2.212	0.389	0.157	0.320	0.615
21	0.229	0.432	0.305	0.457	0.190	0.696	0.564	2.720	0.041	0.157	0.320	0.615
22	0.432	0.279	0.381	0.381	0.229	0.894	0.582	0.813	0.366	0.157	0.320	0.615
23	0.254	0.406	0.356	0.762	0.701	0.909	0.287	0.673	0.366	0.272	0.320	0.615
24	0.102	0.279	0.127	0.635	0.343	0.696	0.048	0.396	0.424	0.274	0.320	0.615
25	0.025	0.330	0.406	0.533	0.627	0.564	0.338	0.462	0.043	0.272	0.320	0.615
26	0.102	0.457	0.102	0.533	0.800	0.401	0.147	0.457	0.117	0.272	0.320	0.615
27	0.152	0.635	0.203	0.737	0.013	1.204	0.071	0.406	0.119	0.274	0.284	0.043
28	0.203	0.330	0.203	0.610	0.572	1.748	2.484	0.386	0.114	0.272	0.284	0.046
29	0.305	----	0.457	0.711	0.653	0.442	0.488	0.490	0.399	0.274	0.284	0.043
30	0.178	----	0.051	0.711	0.490	0.597	0.500	0.650	0.526	0.272	0.284	0.046
31	0.203	----	0.635	----	0.521	----	1.059	0.239	----	0.282	----	0.043

* -- SOME VALUES ARE AVERAGED OVER SEVERAL DAYS

TABLE C39. DAILY EVAPORATION RATES, 1975
cm/day*

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.046	0.521	0.218	0.358	0.279	0.381**	0.698	0.297	0.302	0.206	----	----
2	0.130	0.521	0.218	0.358	0.112	0.526	1.209	0.241	0.495	0.592	----	----
3	0.132	0.521	0.218	0.704	0.683	0.292	0.122	0.348	0.478	0.505	----	----
4	0.130	0.521	0.218	0.704	0.683	0.711	0.518	0.493	0.475	0.234	----	----
5	0.132	0.521	0.218	0.704	0.683	0.813	1.024	0.475	0.617	0.152	----	----
6	0.130	0.190	0.201	0.704	0.279	0.605	0.544	0.391	0.617	0.043	----	----
7	0.132	0.190	0.201	0.704	0.323	0.541	0.269	0.079	0.251	0.145	----	----
8	0.130	0.190	0.201	0.704	0.323	0.612	0.541	0.061	0.071	0.163	----	----
9	0.787	0.190	0.201	0.704	0.323	0.711	0.358	0.305	0.320	0.216	----	----
10	0.787	0.190	0.201	0.704	0.323	0.345	0.490	0.389	0.411	0.180	----	----
11	0.787	0.190	0.201	0.335	0.323	0.770	0.511	0.114	0.165	0.401	----	----
12	0.787	0.190	0.201	0.335	0.323	0.381	0.320	0.193	0.333	0.292	----	----
13	0.787	0.190	0.201	0.335	0.323	0.330	0.508	0.508	0.825	0.490	----	----
14	0.787	0.190	0.201	0.335	0.556	0.696	0.798	0.442	0.394	0.201	----	----
15	0.787	0.190	0.079	0.335	0.109	0.691	0.175	0.498	0.500	0.211	----	----
16	0.198	0.526	0.079	0.335	0.353	0.008	0.455	0.483	0.157	0.340	----	----
17	0.198	0.528	0.079	0.056	0.384	0.790	0.097	0.513	1.163	0.152	----	----
18	0.198	0.526	0.079	0.056	0.229	0.587	0.267	0.665	0.229	0.546	----	----
19	0.198	0.528	0.079	0.056	0.282	0.538	0.584	0.310	0.170	0.239	----	----
20	0.198	0.305	0.079	0.056	0.582	0.640	0.500	0.640	0.269	0.241	----	----
21	0.198	0.305	0.041	0.056	0.566	0.767	0.259	0.472	0.391	0.173	----	----
22	0.198	0.305	0.043	0.056	0.561	0.343	0.467	0.457	0.091	0.417	----	----
23	0.173	0.305	0.041	0.056	0.650	0.780	0.343	0.317	0.190	0.203	----	----
24	0.173	0.305	0.043	0.056	0.711	0.668	0.363	0.528	0.190	0.257	----	----
25	0.173	0.305	0.041	0.056	0.508	0.361	0.460	0.450	0.173	0.206	----	----
26	0.173	0.305	0.043	0.056	0.508	0.361	0.107	0.660	0.218	0.173	----	----
27	0.173	0.305	0.358	0.056	0.538	0.490	0.447	0.483	0.292	0.076	----	----
28	0.173	0.305	0.358	0.056	0.577	0.333	0.444	0.579	0.221	0.038	----	----
29	0.173	----	0.358	0.056	0.498	0.284	0.541	0.051	0.353	0.312	----	----
30	0.521	----	0.358	0.229	0.381	0.884	0.973	0.518	0.251	0.132	----	----
31	0.521	----	0.358	----	0.457	----	0.373	0.447	----	0.218	----	----

* -- SOME VALUES ARE AVERAGED OVER SEVERAL DAYS
** -- ESTIMATED

TABLE D1. EXAMPLE OF INPUT DATA FROM A RUNOFF EVENT

Input Data (Column)	A	B	C	D	E	F	G
Runoff, 061373 P1	1802	0.00	P11A	1810	47.19	1758	0.00
2.5 1973	1829	2.14	P12A	1812	71.57	1805	0.62
	1844	0.39	P13A	1814	58.99	1820	0.65
	1849	1.19	P14A	1816	51.86	1825	0.75
	1909	0.04	P15A	1818	44.34	0	0.00
	1910	0.03	P16A	1828	47.51	0	0.00
	1920	0.02	P17A	1832	59.26	0	0.00
	1937	0.00	P18A	1838	38.68	0	0.00
	0	0.00	P19A	1937	21.65	0	0.00
	-1	0.00			0.00	0	0.00

	C	D	H	I	J	K	L	M M
Pesticide, 061373 P1	P11A	1810	100.0	24.0	0.489E+05	-99.0	0.150E+04	600.0
	P12A	1812	70.0	11.0	0.394E+05	-99.0	0.110E+04	600.0
	P13A	1814	30.0	28.0	0.418E+05	-99.0	900.0	400.0
	P14A	1816	35.0	18.0	0.415E+05	-99.0	900.0	600.0
	P15A	1818	35.0	19.0	0.384E+05	0.0	200.0	0.340E+04
	P16A	1828	30.0	16.0	0.371E+05	0.0	700.0	0.290E+04
	P17A	1832	25.0	11.0	0.308E+05	0.0	600.0	0.140E+04
	P18A	1838	30.0	12.0	0.413E+05	0.0	600.0	0.100E+04
	P19A	1937	30.0	8.0	0.426E+05	-99.0	400.0	100.0
	-1		0.0	0.0	0.0	0.0	0.0	0.0

TABLE D2. EXAMPLE OUTPUT FOR COMPUTED RUNOFF EVENT

	N	O	P	Q	R	C	S	E	T	U	V	W	X	Y	Z	AA	BB
	06/13/73 WATERSHED P-01 FLUME SIZE 2.5 FEET											PESTICIDES (MG)					
	TIME EDT	ELAP TIME	STAG CM	FLOW L/M	VOLUME LITERS	SAMP NO	SAMP TIME	SED. GM/L	T.SED KG.	RAIN TIME	GAGE CM.	TRIFLURLN SED	TRIFLURLN H2O	DIPHENAMD SED	DIPHENAMD H2O	PARAQUAT SED	PARAQUAT H2O
	1758									0	0.0						
	1802	0	0.0	0.	0.					4	0.9						
	1805	3	7.2	230.	260.					7	1.6						
	1810	8	19.3	1557.	4204.	P11A	8	47.2	198.4	12	1.6	19.84	100.89	297.56	2522.20	9700.36	
	1812	10	24.2	2482.	8219.	P12A	10	71.6	287.4	14	1.6	20.12	44.17	316.10	2409.07	11322.08	
	1814	12	29.0	3680.	14348.	P13A	12	59.0	361.6	16	1.6	10.85	171.63	325.43	2451.88	15114.51	
	1816	14	33.8	5143.	23130.	P14A	14	51.9	455.4	18	1.6	15.94	158.06	409.85	5268.64	18898.55	
	1818	16	38.7	6896.	35126.	P15A	16	44.3	531.9	20	1.6	18.62	227.92	106.38	40786.27	20425.01	0.00
	1820	18	43.5	8974.	50962.					22	1.7						
	1825	23	55.6	15713.	111714.					27	1.9						
	1828	26	62.8	20986.	166534.	P16A	26	47.5	6243.2			187.30	2102.54	4370.26	381085.93	231624.12	0.00
	1829	27	65.2	22860.	188457.												
	1832	30	54.6	15062.	244984.	P17A	30	59.3	4648.9			116.22	862.94	2789.35	109829.18	143186.50	0.00
	1838	36	33.2	4946.	301726.	P18A	36	38.7	2194.8			65.84	680.91	1316.88	56742.68	90645.50	0.00
	1844	42	11.9	587.	315932.												
	1849	47	36.3	5989.	329761.												
	1909	67	1.2	10.	369366.												
	1910	68	0.9	6.	369375.												
	1920	78	0.6	3.	369422.												
	1937	95	0.0	0.	369450.	P19A	95	21.6	1466.2			43.99	541.79	586.48	6772.34	62460.63	
	** 06/13/73 WATERSHED P-01 FLUME SIZE 2.5 FEET**																
CC	TOTAL,MG (NOTE 1)				369449.9 LITERS				16387.8 KG			498.71	4890.85	10518.31	607868.07	603377.22	0.00
DD	MEAN, PPB (NOTE 2)								44.4 GM/L			30.43	13.24	641.84	1645.33	36818.76	0.00
EE	LN MEAN								3.8			3.42	2.58	6.46	7.41	10.51	0.00
FF	TOTAL,MG (PRED. NOTE 3)				369450.0 LITERS				16387.8 KG			498.71	4890.85	10518.31	607868.07	603376.98	0.00
GG	MEAN, PPB (PRED. NOTE 3)								44.4 GM/L			30.43	13.24	641.84	1645.33	36818.76	0.00
HH	RAW DATA MAXIMUM (NOTE 2)								71.6 GM/L			100.00	28.00	1500.00	3400.00	48900.02	0.00
II	RAW DATA MINIMUM (NOTE 2)								21.6 GM/L			25.00	8.00	200.00	100.00	30800.02	0.00

NOTE 1. ALL VALUES ARE IN MG UNLESS OTHERWISE NOTED.

NOTE 2. ALL VALUES ARE IN PPB UNLESS OTHERWISE NOTED.

NOTE 3. PREDICTED RESULTS BASED ON MISSING DATA

TABLE D3. METHODS USED FOR RUNOFF DATA COMPUTATIONS

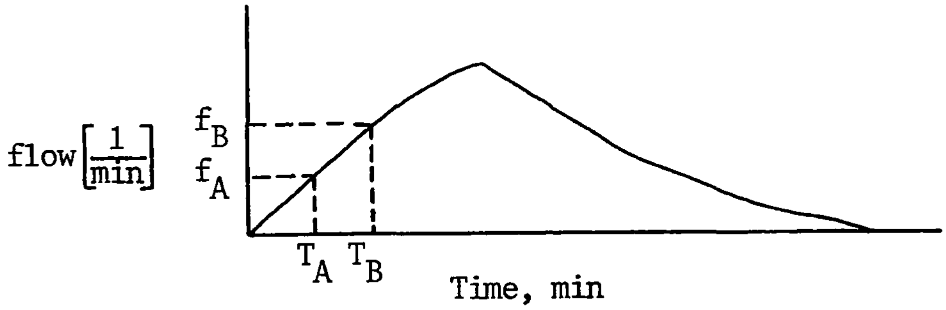
Column	Description
A	Time series of runoff (derived from breakpoint on water stage recorder).
B	Stage height (ft), corresponds to A's times.
C	Sample numbers.
D	Time sample was taken (obtained by mark on water stage recorder).
E	Amount of sediment in sample, g/l.
F	Time series of rainfall (breakpoint on rain chart).
G	Accumulated rainfall (in.) per time (F).
H	Concentration of trifluralin in sediment (see Table D4).
I	Concentration of trifluralin in water (see Table D4).
J	Concentration of paraquat in sediment (see Table D4).
K	Concentration of paraquat in water (see Table D4).
L	Concentration of diphenamid in sediment (see Table D4).
M	Concentration of diphenamid in water (see Table D4).
N	Time (EDT). Chronological time which signifies when rainfall began and any change resulting in a break in the event such as an increase in rainfall, sample being taken or an increase or decrease in the runoff stage height.
O	Elapsed time of runoff or stage height change.
P	Stage height in flume (cm).
Q	Flow rate through the flume. This value is determined by taking stage height in centimeters (column P) and converting it to feet. By using the rating tables for the type flumes found in Agricultural Handbook Number 224, one can determine the discharge in ft^3/sec.

Column	Description
	Example: stage height conversion factor ft^3/sec x 60 sec/min x 28.32 liter/ft^3 = flow (liter/min)
R	Cumulative volume (liters). Volume is determined by approximate integration using the trapezoidal rule.

In the runoff event, each breakpoint on the water stage recorder represents a value for stage height and a corresponding value for time. These corresponding values enables one to compute flow from the flow versus stage height table. This, in turn, provides a plot of flow (liters/min) versus time (min). The flow versus time curve is then integrated by use of the trapezoidal rule to compute the approximate value for the area under the curve. The area under the curve is equal to the volume during the event.

The trapezoidal rule takes each corresponding flow value and time value and computes the area by the following equation:

$$\text{AREA} = \tfrac{1}{2}(\text{flow A} + \text{flow B})\ (\text{Time B} - \text{Time A})$$



This value is the volume that has passed through the flume for the time period (T_B - T_A). This value, in turn, is added to the volume already accumulated. Each time increment is calculated and added to the accumulated volume until the event has ended.

Example:

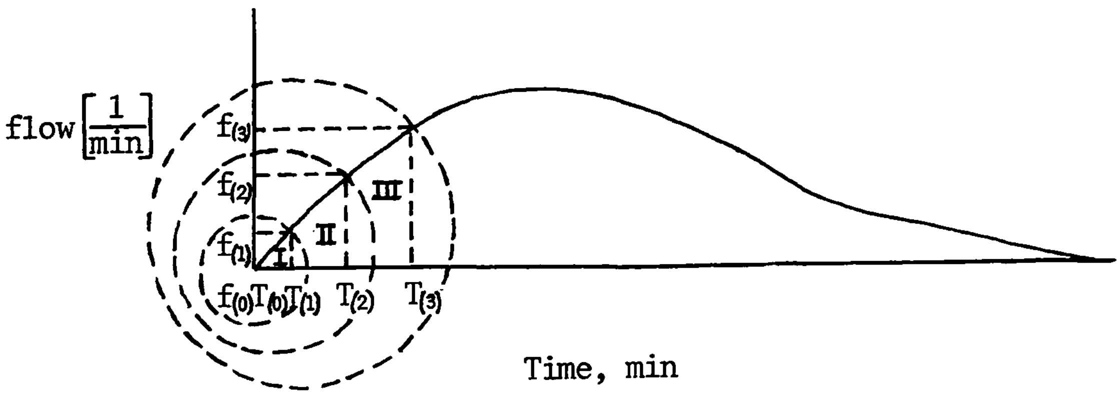


TABLE D3 (continued). METHODS USED FOR RUNOFF DATA COMPUTATIONS

Column	Description
	Volume I = $\frac{1}{2}(f_{(1)} + f_{(0)})\ (T_{(1)} - T_{(0)})$
	Volume II = Volume I + $\frac{1}{2}(f_{(2)} + f_{(1)})\ (T_{(2)} - T_{(1)})$
	Volume III = Volume II + $\frac{1}{2}(f_{(3)} + f_{(2)})\ (T_{(3)} - T_{(2)})$
S	Elapsed time after runoff began and when sample was taken.
T	Total sediment (kg) for the successive flow in column R (volume for corresponding sample - volume for previous sample) x column E x 0.001 kg/g = T. Total sediment (kg) = 1 x g/1 x 1 kg/1000 g.
	Example: (8219 - 4204 liters) x 71.6 g/1 x 0.001 kg/g = 287.4 kg.
	In cases where runoff continued without sampling, the volume of runoff is added to the last sample for computational purposes.
U	Elapsed time after rain began.
V	Accumulated rain gage values in cm.
W	Trifluralin in sediment, mg.
X	Trifluralin in water, mg.
Y	Diphenamid in sediment, mg.
Z	Diphenamid in water, mg.
AA	Paraquat in sediment, mg.
BB	Paraquat in water, mg.
	To calculate total mass of pesticide in the sediment, multiply total sediment (column T) by the concentration of the input data for that particular sample.
	Total (kg) x concentration (g/kg) x 0.001 mg/1 = Total pesticide (mg)
	To calculate the total mass of pesticide in the water, multiply the volume (column R) for that particular sample by the concentration from input data for that sample.
	Volume (liters) x concentration (g/1) x 0.001 mg/1 = Total pesticide (mg)

TABLE D3 (continued). METHODS USED FOR RUNOFF DATA COMPUTATIONS

Column	Description
CC	Totals: Runoff volumes (liters), sediments (kg), pesticides (mg).
DD	Mean values $= \frac{\text{Total sediment (kg)}}{\text{Total water (l)}} \times 1000 =$ g/l of sediment. $= \frac{\text{Total pesticide (mg) in sediment}}{\text{Total sediment (kg)}} \times 1000 =$ ppb pesticide in sediment $= \frac{\text{Total pesticide (mg) in water}}{\text{Total water (l)}} \times 1000 =$ ppb pesticide in water
EE	Ln (mean values).
FF	Predicted values based on missing data. These values are calculated from the samples taken before and after the sample following missing data. These two values are averaged to determine an average pesticide or nutrient concentration. This value is used for the concentration of the missing sample. The concentration is then multiplied by the amount of water, in liters, for the missing sample which will provide a value for total mass of pesticide in the water. If the pesticide sample is a sediment sample, an average concentration is determined and then multiplied times total sediment (kg) for the total mass in the sediment phase.
GG	Mean values for predicted values.
HH	Maximum values from input data (all values in ppb unless noted).
II	Minimum values from input data (all values in ppb unless noted).

Comments: In cases where plant nutrients are analyzed in runoff, an additional column will be present to include the amount of nutrients in rain water. Also, the gain or loss of nutrients is provided.

Order of column H through M (pesticide input data) change from year to year and on different watersheds (see Table D4).

TABLE D4. ARRANGEMENT OF TEST COMPOUNDS ON COMPUTER PRINTOUT BY YEAR AND WATERSHED

Year	Watershed	Input	Output
1972	P1	Trifluralin, Paraquat, Diphenamid	Trifluralin, Diphenamid, Paraquat
1972	P3	Trifluralin, Paraquat, Diphenamid	Trifluralin, Diphenamid, Paraquat
1973	P1	Trifluralin, Paraquat, Diphenamid	Trifluralin, Diphenamid, Paraquat
1973	P2	Paraquat, Atrazine, Chloride	Paraquat, Chloride, Atrazine
1973	P3	Trifluralin, Paraquat, Diphenamid	Trifluralin, Diphenamid, Paraquat
1973	P4	Trifluralin, Paraquat, Diphenamid	Paraquat, Chloride, Atrazine
1974	P1	Paraquat, Diphenamid	Paraquat, Trifluralin, Diphenamid
1974	P2	Paraquat, Atrazine	Paraquat, Atrazine
1974	P3	Paraquat, Diphenamid	Paraquat, Trifluralin, Diphenamid
1974	P4	Paraquat, Atrazine	Paraquat, Atrazine
1975	P1	Propazine, Paraquat	Propazine, Paraquat
1975	P2	Atrazine, Cyanazine, 2,4-D, Paraquat	Atrazine, Cyanazine, 2,4-D, Paraquat
1975	P3	Diphenamid, Paraquat	Diphenamid, Paraquat
1975	P4	Atrazine, Cyanazine, 2,4-D, Paraquat	Atrazine, Cyanazine, 2,4-D, Paraquat

TABLE D5. SOIL CORE DATA COMPUTATIONS

The total mass of compound in a segment at a specific depth zone is calculated by the following:

$$\frac{\text{Concentration}}{\mu g/kg} \times \frac{\text{Area of Segment}}{m^2} \times \frac{\text{Bulk Density}}{g/cm^3} \times$$

$$\frac{\text{Height of Zone}}{cm} \times 1 \times 10^{-5} = \text{Mass of compound in segment per depth zone, g}$$

After this calculation is performed, the mass of compound in each depth zone are summed for total grams of compounds. Then, the weighted mean concentration for each depth zone are computed (data in Appendix G):

$$\frac{\text{Total Mass on Watershed/Zone, g}}{\text{Bulk Density, } g/cm^3 \times \text{Height of Zone, cm} \times \text{Total area of Watershed, } m^2 \times 1 \times 10^{-5}} =$$

$$\text{Mean Concentration, } \mu g/kg \text{ (ppb)}$$

An example of the output data for each sampling interval are presented below:

Sampling Date: 07/10/73
Days After Planting: 25

Depth zones, cm	Segment number 1	2	3	4	5	6	7	8	Totals, g	µg/kg, ppb
0.0-1.0	11.3	9.2	18.1	23.0	6.1	20.9	0.7	0.2	89.6	444.0
1.0-2.5	6.8	20.7	16.9	41.4	12.2	37.6	0.2	0.1	136.0	449.6
2.5-5.0	5.6	9.8	33.9	46.0	10.2	41.8	0.5	0.1	147.9	293.4
5.0-7.5	2.3	2.9	11.3	5.8	0.5	4.7	0.4	0.0	27.8	55.1
7.5-15.0	1.7	3.5	1.7	3.5	1.5	3.1	0.0	0.0	15.0	9.9
15.0-22.5	-	-	-	-	-	-	-	-	-	-
22.5-30.0	-	-	-	-	-	-	-	-	-	-

TABLE E1. DIPHENAMID RUNOFF SUMMARY, WATERSHED P1, 1972

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	07-02-72	1	0.91	247297.	56.	0.0	0.02	72.1	0.0	20.7	1.1	1.1	<.01
2	07-28-72	27	2.54	687236.	214507.	3341.7	31.2	706.0	2359.1	111.5	23909.6	26268.7	31.8
3	07-31-72	30	1.57	426140.	187058.	2673.1	43.9	487.4	1302.8	175.7	32865.7	34168.5	41.4
4	08-10-72	40	2.59	701034.	336530.	3762.4	48.0	685.5	2579.0	52.2	17554.9	20133.9	24.4
5	08-11-72	41	0.41	109849.	4694.	26.9	4.27	1502.7	40.4	51.1	239.8	280.2	0.34
6	08-23-72	53	1.22	329819.	2752.	3.6	0.83	2030.0	7.3	25.3	69.6	76.9	0.09
7	09-04-72	65	1.78	481065.	3315.	5.8	0.69	1394.0	8.1	17.9	59.3	67.4	0.08
8	10-27-72	118	4.37	1182099.	6706.	42.7	0.57	519.0	22.2	11.9	79.8	102.0	0.12
9	11-07-72	129	2.41	652874.	385.	0.0	0.06	0.0	0.0	3.4	1.3	1.3	<.01
10	11-13-72	135	1.45	391779.	598.	0.1	0.15	0.0	0.0	6.7	4.0	4.0	<.01
11	12-05-72	157	2.16	584151.	179.	0.0	0.03	0.0	0.0	5.8	1.0	1.0	<.01
12	12-14-72	166	11.28	3051435.	545614.	367.1	17.9	657.8	241.5	2.1	1131.9	1373.4	1.67
13	12-20-72	172	6.10	1649365.	43313.	49.8	2.63						
14	01-05-73	188	1.78	481065.	717.	0.1	0.15						
15	01-22-73	205	2.46	666673.	11137.	40.2	1.67						
16	01-26-73	209	2.29	618512.	8541.	5.8	1.38						
17	02-01-73	215	4.90	1326310.	193179.	902.5	14.6						
18	03-06-73	248	1.02	274894.	175.	0.2	0.06						
19	03-11-73	253	4.57	1237024.	174289.	496.1	14.1						
20	03-16-73	258	5.21	1408832.	435209.	5532.9	30.9						
21	03-30-73	272	4.83	1305747.	282257.	543.9	21.6						
22	03-31-73	273	3.10	838481.	466916.	3905.2	55.7						
23	04-08-73	281	8.61	2329837.	402865.	2206.0	17.3						
24	05-28-73	331	5.46	1477556.	800396.	26566.4	54.2						
25	05-28-73	331	4.47	1209426.	537591.	20040.9	44.5						
26	06-06-73	340	3.69	997033.	554112.	36094.2	55.6						
27	06-09-73	343	1.27	343618.	89372.	1901.8	26.0						
28	06-10-73	344	0.63	171809.	43020.	825.3	25.0						
TOTAL			93.07	25180959.	5345481.	109334.7	----	--------	6560.4	-------	75918.0	82478.4	----

TABLE E2. PARAQUAT RUNOFF SUMMARY, WATERSHED P1, 1972

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	07-02-72	1	0.91	247297.	56.	0.0	0.02	0.0	0.0	0.0	0.0	0.0	0.0
2	07-28-72	27	2.54	687236.	214507.	3341.7	31.2	224257.6	749412.1	1.1	240.0	749652.1	35.5
3	07-31-72	30	1.57	426140.	187058.	2673.1	43.9	167611.8	448046.1	0.0	0.0	448046.1	21.2
4	08-10-72	40	2.59	701034.	336530.	3762.4	48.0	227827.4	857170.1	0.0	0.0	857170.1	40.6
5	08-11-72	41	0.41	109849.	4694.	26.9	4.27	228319.4	6139.8	0.0	0.0	6139.8	0.29
6	08-23-72	53	1.22	329819.	2752.	3.6	0.83	220000.1	793.1	0.0	0.0	793.1	0.04
7	09-04-72	65	1.78	481065.	3315.	5.8	0.69	120000.2	696.1	0.0	0.0	696.1	0.03
8	10-27-72	118	4.37	1182099.	6706.	42.7	0.57	23000.0	982.2	0.0	0.0	982.2	0.05
9	11-07-72	129	2.41	652874.	385.	0.0	0.06	0.0	0.0			0.0	0.0
10	11-13-72	135	1.45	391779.	598.	0.1	0.15	200000.2	10.8			10.8	<.01
11	12-05-72	157	2.16	584151.	179.	0.0	0.03	200000.2	3.6	0.0	0.0	3.6	<.01
12	12-14-72	166	11.28	3051435.	545614.	367.1	17.9	132670.3	48704.8	0.0	0.0	48704.8	2.31
13	12-20-72	172	6.10	1649365.	43313.	49.8	2.63						
14	01-05-73	188	1.78	481065.	717.	0.1	0.15						
15	01-22-73	205	2.46	666673.	11137.	40.2	1.67						
16	01-26-73	209	2.29	618512.	8541.	5.8	1.38						
17	02-01-73	215	4.90	1326310.	193179.	902.5	14.6						
18	03-06-73	248	1.02	274894.	175.	0.2	0.06						
19	03-11-73	253	4.57	1237024.	174289.	496.1	14.1						
20	03-16-73	258	5.21	1408832.	435209.	5532.9	30.9						
21	03-30-73	272	4.83	1305747.	282257.	543.9	21.6						
22	03-31-73	273	3.10	838481.	466916.	3905.2	55.7						
23	04-08-73	281	8.61	2329837.	402865.	2206.0	17.3						
24	05-28-73	331	5.46	1477556.	800396.	26566.4	54.2						
25	05-28-73	331	4.47	1209426.	537591.	20040.9	44.5						
26	06-06-73	340	3.69	997033.	554112.	36094.2	55.6						
27	06-09-73	343	1.27	343618.	89372.	1901.8	26.0						
28	06-10-73	344	0.63	171809.	43020.	825.3	25.0						
TOTAL			93.07	25180959.	5345481.	109334.7	----	--------	2111958.7	-------	240.0	2112198.7	----

TABLE E3. TRIFLURALIN RUNOFF SUMMARY, WATERSHED P1, 1972

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	07-02-72	1	0.91	247297.	56.	0.0	0.02	144.7	0.0	0.0	0.0	0.0	0.0
2	07-28-72	27	2.54	687236.	214507.	3341.7	31.2	38.1	127.4	6.4	1366.8	1494.2	40.0
3	07-31-72	30	1.57	426140.	187058.	2673.1	43.9	26.6	71.1	3.4	630.6	701.7	18.8
4	08-10-72	40	2.59	701034.	336530.	3762.4	48.0	53.1	199.9	3.9	1308.9	1508.8	40.4
5	08-11-72	41	0.41	109849.	4694.	26.9	4.27	84.0	2.3	3.6	16.9	19.2	0.51
6	08-23-72	53	1.22	329819.	2752.	3.6	0.83	145.0	0.5	3.0	8.3	8.8	0.24
7	09-04-72	65	1.78	481065.	3315.	5.8	0.69	90.0	0.5	1.0	3.3	3.8	0.10
8	10-27-72	118	4.37	1182099.	6706.	42.7	0.57	0.0	0.0	0.0	0.0	0.0	0.0
9	11-07-72	129	2.41	652874.	385.	0.0	0.06	0.0	0.0	0.0	0.0	0.0	0.0
10	11-13-72	135	1.45	391779.	598.	0.1	0.15	0.0	0.0	0.0	0.0	0.0	0.0
11	12-05-72	157	2.16	584151.	179.	0.0	0.03	0.0	0.0	0.0	0.0	0.0	0.0
12	12-14-72	166	11.28	3051435.	545614.	367.1	17.9	0.0	0.0	0.0	0.0	0.0	0.0
13	12-20-72	172	6.10	1649365.	43313.	49.8	2.63						
14	01-05-73	188	1.78	481065.	717.	0.1	0.15						
15	01-22-73	205	2.46	666673.	11137.	40.2	1.67						
16	01-26-73	209	2.29	618512.	8541.	5.8	1.38						
17	02-01-73	215	4.90	1326310.	193179.	902.5	14.6						
18	03-06-73	248	1.02	274894.	175.	0.2	0.06						
19	03-11-73	253	4.57	1237024.	174289.	496.1	14.1						
20	03-16-73	258	5.21	1408832.	435209.	5532.9	30.9						
21	03-30-73	272	4.83	1305747.	282257.	543.9	21.6						
22	03-31-73	273	3.10	838481.	466916.	3905.2	55.7						
23	04-08-73	281	8.61	2329837.	402865.	2206.0	17.3						
24	05-28-73	331	5.46	1477556.	800396.	26566.4	54.2						
25	05-28-73	331	4.47	1209426.	537591.	20040.9	44.5						
26	06-06-73	340	3.69	997033.	554112.	36094.2	55.6						
27	06-09-73	343	1.27	343618.	89372.	1901.8	26.0						
28	06-10-73	344	0.63	171809.	43020.	825.3	25.0						
TOTAL			93.07	25180959.	5345481.	109334.7	----	--------	401.7	-------	3334.8	3736.5	----

TABLE E4. DIPHENAMID RUNOFF SUMMARY, WATERSHED P3, 1972

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	07-02-72	2	1.14	144074.	363.	2.2	0.25	1155.6	2.5	2065.5	749.3	751.8	1.07
2	07-02-72	2	1.90	240124.	41203.	559.5	17.2	778.6	435.6	641.5	26431.6	26867.2	38.2
3	07-05-72	5	0.61	76890.	255.	1.9	0.33	1197.4	2.3	209.2	53.4	55.7	0.08
4	07-28-72	28	2.01	252981.	130560.	496.6	51.6	1346.5	668.6	71.5	9330.7	9999.3	14.2
5	07-29-72	29	0.46	57605.	14383.	33.1	25.0	1436.1	47.5	182.3	2622.4	2669.9	3.79
6	07-31-72	31	1.14	144074.	78363.	484.0	54.4	1662.7	804.7	225.1	17637.4	18442.1	26.2
7	08-09-72	40	0.81	102478.	13889.	31.3	13.6	1731.4	54.2	118.6	1647.6	1701.8	2.42
8	08-10-72	41	1.09	137646.	64863.	176.0	47.1	1088.5	191.6	38.0	2466.3	2657.9	3.78
9	08-23-72	54	1.73	217687.	64673.	169.1	29.7	989.9	167.4	21.9	1416.9	1584.3	2.25
10	09-04-72	66	4.93	621171.	260885.	522.6	42.0	779.1	407.1	16.2	4228.0	4635.1	6.59
11	11-07-72	130	2.46	310585.	1745.	0.7	0.56	0.0	0.0	6.3	11.0	11.0	0.02
12	11-13-72	136	1.14	144074.	98.	0.2	0.07	0.0	0.0	7.7	0.8	0.8	<.01
13	11-19-72	142	2.59	326594.	2963.	0.9	0.91	0.0	0.0	4.7	13.9	13.9	0.02
14	11-25-72	148	1.98	249704.	1337.	0.3	0.54	0.0	0.0	3.0	4.0	4.0	<.01
15	12-05-72	158	2.16	272140.	1338.	0.0	0.49	0.0	0.0	12.5	16.7	16.7	0.02
16	12-14-72	167	11.66	1469608.	483036.	282.5	32.9	303.2	85.7	1.8	885.5	971.2	1.38
17	12-21-72	174	4.57	576297.	68696.	43.3	11.9						
18	01-21-73	205	2.67	336174.	213338.	390.7	63.5						
19	01-25-73	209	2.36	297729.	23280.	12.2	7.82						
20	02-01-73	216	5.00	630751.	130757.	145.4	20.7						
21	03-06-73	249	1.02	128066.	518.	0.2	0.40						
22	03-11-73	254	4.39	553861.	129313.	57.3	23.3						
23	03-16-73	259	4.95	624322.	247433.	329.1	39.6						
24	03-30-73	273	4.83	608314.	217619.	85.7	35.8						
25	03-31-73	274	3.20	403358.	228032.	286.9	56.5						
26	04-07-73	281	6.40	806841.	223678.	614.2	27.7						
27	05-28-73	332	4.83	608314.	197030.	1413.8	32.4						
28	05-28-73	332	4.32	544281.	233537.	2039.4	42.9						
29	06-06-73	341	3.94	496256.	79945.	510.9	16.1						
30	06-07-73	342	1.19	150503.	59706.	482.9	39.7						
TOTAL			91.49	11532501.	3212835.	9172.9	----	--------	2867.2	-------	67515.5	70382.7	----

TABLE E5. PARAQUAT RUNOFF SUMMARY, WATERSHED P3, 1972

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	07-02-72	2	1.14	144074.	363.	2.2	0.25	805402.9	1741.8	578.8	210.0	1951.8	0.30
2	07-02-72	2	1.90	240124.	41203.	559.5	17.2	420866.1	235460.5	152.8	6295.1	241755.6	36.8
3	07-05-72	5	0.61	76890.	255.	1.9	0.33	423029.3	811.2	12.5	3.2	814.4	0.12
4	07-28-72	28	2.01	252981.	130560.	496.6	51.6	239584.6	118970.7	0.0	0.0	118970.7	18.1
5	07-29-72	29	0.46	57605.	14383.	33.1	25.0	249302.2	8253.1	0.0	0.0	8253.1	1.26
6	07-31-72	31	1.14	144074.	78363.	484.0	54.4	190088.9	91998.1	0.0	0.0	91998.1	14.0
7	08-09-72	40	0.81	102478.	13889.	31.3	13.6	258663.3	8093.8	0.0	0.0	8093.8	1.23
8	08-10-72	41	1.09	137646.	64863.	176.0	47.1	225559.2	39703.2	0.0	0.0	39703.2	6.04
9	08-23-72	54	1.73	217687.	64673.	169.1	29.7	211037.6	35680.9	0.0	0.0	35680.9	5.43
10	09-04-72	66	4.93	621171.	260885.	522.6	42.0	150171.6	78472.7	0.0	0.0	78472.7	11.9
11	11-07-72	130	2.46	310585.	1745.	0.7	0.56	160000.2	106.1	0.0	0.0	106.1	0.02
12	11-13-72	136	1.14	144074.	98.	0.2	0.07	140000.2	27.0	0.0	0.0	27.0	<.01
13	11-19-72	142	2.59	326594.	2963.	0.9	0.91	120000.2	103.1	0.0	0.0	103.1	0.02
14	11-25-72	148	1.98	249704.	1337.	0.3	0.54	140000.2	46.8	0.0	0.0	46.8	<.01
15	12-05-72	158	2.16	272140.	1338.	0.0	0.49	0.0	0.0	0.0	0.0	0.0	0.0
16	12-14-72	167	11.66	1469608.	483036.	282.5	32.9	110000.2	31075.6	0.0	0.0	31075.6	4.73
17	12-21-72	174	4.57	576297.	68696.	43.3	11.9						
18	01-21-73	205	2.67	336174.	213338.	390.7	63.5						
19	01-25-73	209	2.36	297729.	23280.	12.2	7.82						
20	02-01-73	216	5.00	630751.	130757.	145.4	20.7						
21	03-06-73	249	1.02	128066.	518.	0.2	0.40						
22	03-11-73	254	4.39	553861.	129313.	57.3	23.3						
23	03-16-73	259	4.95	624322.	247433.	329.1	39.6						
24	03-30-73	273	4.83	608314.	217619.	85.7	35.8						
25	03-31-73	274	3.20	403358.	228032.	286.9	56.5						
26	04-07-73	281	6.40	806841.	223678.	614.2	27.7						
27	05-28-73	332	4.83	608314.	197030.	1413.8	32.4						
28	05-28-73	332	4.32	544281.	233537.	2039.4	42.9						
29	06-06-73	341	3.94	496256.	79945.	510.9	16.1						
30	06-07-73	342	1.19	150503.	59706.	482.9	39.7						
TOTAL			91.49	11532501.	3212835.	9172.9	----	--------	650544.6	-------	6508.3	657052.9	----

TABLE E6. TRIFLURALIN RUNOFF SUMMARY, WATERSHED P3, 1972

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	07-02-72	2	1.14	144074.	363.	2.2	0.25	284.1	0.6	21.2	7.7	8.3	0.30
2	07-02-72	2	1.90	240124.	41203.	559.5	17.2	118.6	66.3	8.9	367.2	433.5	15.9
3	07-05-72	5	0.61	76890.	255.	1.9	0.33	14.4	0.0	3.3	0.9	0.9	0.03
4	07-28-72	28	2.01	252981.	130560.	496.6	51.6	160.8	79.9	6.7	877.8	957.7	35.2
5	07-29-72	29	0.46	57605.	14383.	33.1	25.0	109.5	3.6	3.9	55.5	59.1	2.17
6	07-31-72	31	1.14	144074.	78363.	484.0	54.4	174.1	84.3	1.8	142.4	226.7	8.33
7	08-09-72	40	0.81	102478.	13889.	31.3	13.6	204.4	6.4	5.9	81.4	87.8	3.22
8	08-10-72	41	1.09	137646.	64863.	176.0	47.1	44.5	7.8	3.7	237.2	245.0	9.00
9	08-23-72	54	1.73	217687.	64673.	169.1	29.7	83.0	14.0	2.2	142.7	156.7	5.76
10	09-04-72	66	4.93	621171.	260885.	522.6	42.0	63.7	33.3	2.0	513.8	547.1	20.1
11	11-07-72	130	2.46	310585.	1745.	0.7	0.56	0.0	0.0	0.0	0.0	0.0	0.0
12	11-13-72	136	1.14	144074.	98.	0.2	0.07	0.0	0.0	0.0	0.0	0.0	0.0
13	11-19-72	142	2.59	326594.	2963.	0.9	0.91	0.0	0.0	0.0	0.0	0.0	0.0
14	11-25-72	148	1.98	249704.	1337.	0.3	0.54	0.0	0.0	0.0	0.0	0.0	0.0
15	12-05-72	158	2.16	272140.	1338.	0.0	0.49	0.0	0.0	0.0	0.0	0.0	0.0
16	12-14-72	167	11.66	1469608.	483036.	282.5	32.9	0.0	0.0	0.0	0.0	0.0	0.0
17	12-21-72	174	4.57	576297.	68696.	43.3	11.9						
18	01-21-73	205	2.67	336174.	213338.	390.7	63.5						
19	01-25-73	209	2.36	297729.	23280.	12.2	7.82						
20	02-01-73	216	5.00	630751.	130757.	145.4	20.7						
21	03-06-73	249	1.02	128066.	518.	0.2	0.40						
22	03-11-73	254	4.39	553861.	129313.	57.3	23.3						
23	03-16-73	259	4.95	624322.	247433.	329.1	39.6						
24	03-30-73	273	4.83	608314.	217619.	85.7	35.8						
25	03-31-73	274	3.20	403358.	228032.	286.9	56.5						
26	04-07-73	281	6.40	806841.	223678.	614.2	27.7						
27	05-28-73	332	4.83	608314.	197030.	1413.8	32.4						
28	05-28-73	332	4.32	544281.	233537.	2039.4	42.9						
29	06-06-73	341	3.94	496256.	79945.	510.9	16.1						
30	06-07-73	342	1.19	150503.	59706.	482.9	39.7						
TOTAL			91.49	11532501.	3212835.	9172.9	----	--------	296.2	-------	2426.6	2722.8	----

TABLE E7. DIPHENAMID RUNOFF SUMMARY, WATERSHED P1, 1973

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	06-13-73	0	1.90	515427.	369450.	16387.8	71.7	641.8	10518.3	1645.3	607868.1	618386.4	94.8
2	06-21-73	8	1.90	515427.	112398.	2366.6	21.8	670.8	1587.6	245.9	27637.6	29225.2	4.48
3	06-28-73	15	0.38	103085.	15764.	259.3	15.3	200.0	51.9	65.0	1024.6	1076.5	0.17
4	07-08-73	25	1.78	481065.	132826.	1360.7	27.6	160.6	218.5	13.3	1766.5	1985.0	0.30
5	07-17-73	34	0.76	206171.	25825.	133.3	12.5	349.8	46.6	10.0	258.2	304.8	0.05
6	07-30-73	47	2.79	755959.	354677.	3924.5	46.9	120.6	473.5	2.0	709.4	1182.9	0.18
7	08-17-73	65	1.14	309256.	2099.	13.4	0.68	60.0	0.8	1.0	2.1	2.9	<.01
8	08-18-73	66	0.89	240533.	34167.	169.4	14.2	81.8	13.9	1.0	34.2	48.1	<.01
9	09-09-73	88	4.06	1099577.	404042.	2118.2	36.7	63.8	135.2	0.0	0.0	135.2	0.02
10	09-13-73	92	3.18	859045.	224745.	957.5	26.2						
11	12-05-73	175	3.99	1079014.	20140.	11.9	1.87						
12	12-20-73	190	1.93	522191.	7362.	4.6	1.41						
13	12-31-73	201	5.26	1422631.	478409.	2285.5	33.6						
14	01-20-74	221	2.21	597949.	3372.	2.7	0.56						
15	02-06-74	238	4.32	1168300.	96066.	259.3	8.22						
16	02-15-74	247	2.29	618512.	2152.	0.0	0.35						
17	02-22-74	254	1.51	408013.	4246.	13.2	1.04						
18	03-29-74	289	1.85	501628.	20934.	92.4	4.17						
19	04-04-74	295	3.30	893406.	238922.	2034.7	26.7						
20	04-13-74	304	2.29	618512.	117572.	465.7	19.0						
TOTAL			47.74	12915700.	2665168.	32860.7	----	--------	13046.3	-------	639300.7	652347.0	----

TABLE E8. PARAQUAT RUNOFF SUMMARY, WATERSHED P1, 1973

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	06-13-73	0	1.90	515427.	369450.	16387.8	71.7	36818.7	603377.1	0.0	0.0	603377.1	66.2
2	06-21-73	8	1.90	515427.	112398.	2366.6	21.8	35565.4	84168.4			84168.4	9.24
3	06-28-73	15	0.38	103085.	15764.	259.3	15.3	61500.0	15947.3			15947.3	1.75
4	07-08-73	25	1.78	481065.	132826.	1360.7	27.6	29697.3	40409.7			40409.7	4.43
5	07-17-73	34	0.76	206171.	25825.	133.3	12.5	38014.3	5068.5			5068.5	0.56
6	07-30-73	47	2.79	755959.	354677.	3924.5	46.9	27634.9	108453.0			108453.0	11.9
7	08-17-73	65	1.14	309256.	2099.	13.4	0.68	25700.0	345.2			345.2	0.04
8	08-18-73	66	0.89	240533.	34167.	169.4	14.2	50110.3	8488.1			8488.1	0.93
9	09-09-73	88	4.06	1099577.	404042.	2118.2	36.7	21208.7	44923.8			44923.8	4.93
10	09-13-73	92	3.18	859045.	224745.	957.5	26.2						
11	12-05-73	175	3.99	1079014.	20140.	11.9	1.87						
12	12-20-73	190	1.93	522191.	7362.	4.6	1.41						
13	12-31-73	201	5.26	1422631.	478409.	2285.5	33.6						
14	01-20-74	221	2.21	597949.	3372.	2.7	0.56						
15	02-06-74	238	4.32	1168300.	96066.	259.3	8.22						
16	02-15-74	247	2.29	618512.	2152.	0.0	0.35						
17	02-22-74	254	1.51	408013.	4246.	13.2	1.04						
18	03-29-74	289	1.85	501628.	20934.	92.4	4.17						
19	04-04-74	295	3.30	893406.	238922.	2034.7	26.7	0.0	0.0	0.0	0.0	0.0	0.0
20	04-13-74	304	2.29	618512.	117572.	465.7	19.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL			47.74	12915700.	2665168.	32860.7	----	--------	911181.1	-------	0.0	911181.1	----

TABLE E9. TRIFLURALIN RUNOFF SUMMARY, WATERSHED P1, 1973

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	06-13-73	0	1.90	515427.	369450.	16387.8	71.7	30.4	498.7	13.2	4890.9	5389.6	69.7
2	06-21-73	8	1.90	515427.	112398.	2366.6	21.8	32.1	76.1	5.7	638.9	715.0	9.24
3	06-28-73	15	0.38	103085.	15764.	259.3	15.3	10.0	2.6	2.0	31.5	34.1	0.44
4	07-08-73	25	1.78	481065.	132826.	1360.7	27.6	20.6	28.0	4.5	596.6	624.6	8.07
5	07-17-73	34	0.76	206171.	25825.	133.3	12.5	57.4	7.7	5.0	129.1	136.8	1.77
6	07-30-73	47	2.79	755959.	354677.	3924.5	46.9	19.7	77.2	2.1	736.4	813.6	10.5
7	08-17-73	65	1.14	309256.	2099.	13.4	0.68	10.0	0.1	0.0	0.0	0.1	<.01
8	08-18-73	66	0.89	240533.	34167.	169.4	14.2	10.0	1.7	0.0	0.0	1.7	0.02
9	09-09-73	88	4.06	1099577.	404042.	2118.2	36.7	10.0	21.1	0.0	0.0	21.1	0.27
10	09-13-73	92	3.18	859045.	224745.	957.5	26.2						
11	12-05-73	175	3.99	1079014.	20140.	11.9	1.87						
12	12-20-73	190	1.93	522191.	7362.	4.6	1.41						
13	12-31-73	201	5.26	1422631.	478409.	2285.5	33.6						
14	01-20-74	221	2.21	597949.	3372.	2.7	0.56						
15	02-06-74	238	4.32	1168300.	96066.	259.3	8.22						
16	02-15-74	247	2.29	618512.	2152.	0.0	0.35						
17	02-22-74	254	1.51	408013.	4246.	13.2	1.04						
18	03-29-74	289	1.85	501628.	20934.	92.4	4.17						
19	04-04-74	295	3.30	893406.	238922.	2034.7	26.7						
20	04-13-74	304	2.29	618512.	117572.	465.7	19.0						
TOTAL			47.74	12915700.	2665168.	32860.7	----	--------	713.2	-------	7023.4	7736.6	----

TABLE E10. ATRAZINE RUNOFF SUMMARY, WATERSHED P2, 1973

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	05-19-73	8	1.22	157608.	331.	2.3	0.21	3232.5	7.5	200.0	66.3	73.8	0.09
2	05-23-73	12	1.90	246304.	74571.	931.6	30.3	855.5	797.0	179.0	13344.6	14141.6	16.9
3	05-28-73	17	5.59	722490.	518670.	5638.3	71.8	892.1	5030.0	64.4	33393.2	38423.2	45.9
4	05-28-73	17	5.26	679824.	436595.	5067.1	64.2	785.2	3978.8	43.7	19097.6	23076.4	27.6
5	06-06-73	26	3.10	400680.	278503.	1440.3	69.5	879.0	1266.1	14.0	3898.6	5164.7	6.17
6	06-09-73	29	1.14	147782.	18045.	34.5	12.2	749.0	25.8	17.3	312.3	338.1	0.40
7	06-10-73	30	0.63	82101.	6227.	25.2	7.58	900.0	22.6	36.0	224.1	246.7	0.29
8	06-13-73	33	1.98	256130.	89195.	689.2	34.8	425.1	293.0	6.8	607.4	900.4	1.08
9	06-21-73	41	0.91	118174.	59286.	223.0	50.2	587.0	130.9	8.9	526.0	656.9	0.78
10	07-08-73	58	4.09	528680.	239645.	548.7	45.3	200.0	109.7	2.4	567.8	677.5	0.81
11	07-30-73	80	2.01	259492.	2084.	2.7	0.80						
12	09-09-73	121	4.95	640390.	47862.	31.0	7.47						
13	09-13-73	125	2.08	269318.	91989.	43.0	34.2						
14	12-06-73	209	3.99	515622.	7179.	2.4	1.39						
15	12-20-73	223	1.93	249536.	2291.	1.5	0.92						
16	12-30-73	233	2.29	295564.	1061.	0.5	0.36						
17	12-31-73	234	5.26	679824.	146316.	70.4	21.5						
18	01-20-74	254	2.21	285738.	2247.	1.1	0.79						
19	02-06-74	271	4.32	558288.	19973.	0.0	3.58						
20	02-07-74	272	0.51	65681.	499.	0.0	0.76						
21	02-15-74	280	2.29	295564.	3957.	0.0	1.34						
22	02-22-74	287	1.27	164203.	809.	0.0	0.49						
23	03-29-74	322	1.75	226651.	2484.	1.1	1.10	0.0	0.0	0.0	0.0	0.0	0.0
24	04-04-74	328	3.30	426926.	35517.	12.5	8.32						
25	04-13-74	337	2.29	295564.	45350.	18.8	15.3						
TOTAL			66.27	8568135.	2130686.	14785.2	----	--------	11661.4	-------	72037.9	83699.3	----

TABLE E11. PARAQUAT RUNOFF SUMMARY, WATERSHED P2, 1973

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	05-19-73	8	1.22	157608.	331.	2.3	0.21	60472.7	140.1	0.0	0.0	140.1	0.06
2	05-23-73	12	1.90	246304.	74571.	931.6	30.3	24966.0	23259.4	0.0	0.0	23259.4	10.7
3	05-28-73	17	5.59	722490.	518670.	5638.3	71.8	18952.6	106860.4	0.0	0.0	106860.4	49.4
4	05-28-73	17	5.26	679824.	436595.	5067.1	64.2	11201.1	56757.0	0.0	0.0	56757.0	26.2
5	06-06-73	26	3.10	400680.	278503.	1440.3	69.5	9542.8	13744.3	0.0	0.0	13744.3	6.35
6	06-09-73	29	1.14	147782.	18045.	34.5	12.2	11583.6	399.8	0.0	0.0	399.8	0.18
7	06-10-73	30	0.63	82101.	6227.	25.2	7.58	10600.0	266.6	0.0	0.0	266.6	0.12
8	06-13-73	33	1.98	256130.	89195.	689.2	34.8	9578.9	6601.6	0.0	0.0	6601.6	3.05
9	06-21-73	41	0.91	118174.	59286.	223.0	50.2	4549.9	1014.5			1014.5	0.47
10	07-08-73	58	4.09	528680.	239645.	548.7	45.3	13529.8	7423.9			7423.9	3.43
11	07-30-73	80	2.01	259492.	2084.	2.7	0.80						
12	09-09-73	121	4.95	640390.	47862.	31.0	7.47						
13	09-13-73	125	2.08	269318.	91989.	43.0	34.2						
14	12-06-73	209	3.99	515622.	7179.	2.4	1.39						
15	12-20-73	223	1.93	249536.	2291.	1.5	0.92						
16	12-30-73	233	2.29	295564.	1061.	0.5	0.36						
17	12-31-73	234	5.26	679824.	146316.	70.4	21.5						
18	01-20-74	254	2.21	285738.	2247.	1.1	0.79						
19	02-06-74	271	4.32	558288.	19973.	0.0	3.58						
20	02-07-74	272	0.51	65681.	499.	0.0	0.76						
21	02-15-74	280	2.29	295564.	3957.	0.0	1.34						
22	02-22-74	287	1.27	164203.	809.	0.0	0.49						
23	03-29-74	322	1.75	226651.	2484.	1.1	1.10						
24	04-04-74	328	3.30	426926.	35517.	12.5	8.32						
25	04-13-74	337	2.29	295564.	45350.	18.8	15.3						
TOTAL			66.27	8568135.	2130686.	14785.2	----	--------	216467.6	-------	0.0	216467.6	----

TABLE E12. DIPHENAMID RUNOFF SUMMARY, WATERSHED P3, 1973

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	07-08-73	23	6.43	809992.	330167.	1492.4	40.8	634.8	947.4	60.5	19986.3	20933.7	83.1
2	07-14-73	29	1.90	240124.	81929.	265.7	34.1	447.6	118.9	38.5	3152.8	3271.7	13.0
3	07-17-73	32	0.94	118486.	29623.	82.9	25.0	447.8	37.1	30.0	888.7	925.8	3.68
4	09-09-73	86	4.44	560289.	186637.	72.9	33.3	6.8	0.5	0.3	48.8	49.3	0.20
5	09-13-73	90	3.43	432223.	88319.	31.7	20.4						
6	12-20-73	188	2.62	329745.	32461.	48.7	9.84						
7	12-31-73	199	5.39	678775.	114901.	98.3	16.9						
8	01-20-74	219	2.34	294577.	3006.	4.2	1.02						
9	04-13-74	302	2.54	320165.	26427.	52.9	8.25	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL			30.02	3784377.	893469.	2149.7	----	--------	1103.9	-------	24076.6	25180.5	----

TABLE E13. PARAQUAT RUNOFF SUMMARY, WATERSHED P3, 1973

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	07-08-73	23	6.43	809992.	330167.	1492.4	40.8	56261.8	83963.5			83963.5	79.9
2	07-14-73	29	1.90	240124.	81929.	265.7	34.1	50597.2	13443.5			13443.5	12.8
3	07-17-73	32	0.94	118486.	29623.	82.9	25.0	38929.8	3225.5			3225.5	3.07
4	09-09-73	86	4.44	560289.	186637.	72.9	33.3	61165.1	4457.1			4457.1	4.24
5	09-13-73	90	3.43	432223.	88319.	31.7	20.4						
6	12-20-73	188	2.62	329745.	32461.	48.7	9.84						
7	12-31-73	199	5.39	678775.	114901.	98.3	16.9						
8	01-20-74	219	2.34	294577.	3006.	4.2	1.02						
9	04-13-74	302	2.54	320165.	26427.	52.9	8.25						
TOTAL			30.02	3784377.	893469.	2149.7	----	--------	105089.6	-------		105089.6	----

TABLE E14. TRIFLURALIN RUNOFF SUMMARY, WATERSHED P3, 1973

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	07-08-73	23	6.43	809992.	330167.	1492.4	40.8	92.5	138.0	8.4	2775.5	2913.5	87.2
2	07-14-73	29	1.90	240124.	81929.	265.7	34.1	69.9	18.6	4.3	353.2	371.8	11.1
3	07-17-73	32	0.94	118486.	29623.	82.9	25.0	14.8	1.2	1.8	53.2	54.4	1.63
4	09-09-73	86	4.44	560289.	186637.	72.9	33.3	2.4	0.2	0.0	0.0	0.2	<.01
5	09-13-73	90	3.43	432223.	88319.	31.7	20.4						
6	12-20-73	188	2.62	329745.	32461.	48.7	9.84						
7	12-31-73	199	5.39	678775.	114901.	98.3	16.9						
8	01-20-74	219	2.34	294577.	3006.	4.2	1.02						
9	04-13-74	302	2.54	320165.	26427.	52.9	8.25						
TOTAL			30.02	3784377.	893469.	2149.7	----	--------	158.0	-------	3181.9	3339.9	----

TABLE E15. ATRAZINE RUNOFF SUMMARY, WATERSHED P4, 1973

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	05-23-73	12	1.22	171439.	2609.	13.5	1.52	564.4	7.6	157.7	411.3	418.9	1.08
2	05-28-73	17	4.83	678723.	356900.	1609.4	52.6	543.8	875.3	48.6	17362.3	18237.6	47.0
3	05-28-73	17	4.32	607279.	337259.	1613.2	55.5	491.2	792.4	42.7	14392.2	15184.6	39.2
4	06-06-73	26	3.94	553696.	280598.	796.2	50.7	338.9	269.8	10.9	3069.8	3339.6	8.61
5	06-07-73	27	1.12	157234.	80515.	276.3	51.2	235.3	65.0	10.1	810.7	875.7	2.26
6	06-13-73	33	0.89	125028.	16773.	42.6	13.4	200.0	8.5	12.0	201.3	209.8	0.54
7	07-08-73	58	6.43	903745.	411194.	756.1	45.5	57.1	43.2	1.0	409.5	452.7	1.17
8	07-14-73	64	1.90	267917.	61563.	59.3	23.0	71.7	4.3	1.0	61.6	65.9	0.17
9	07-17-73	67	0.94	132201.	9328.	11.5	7.06						
10	09-09-73	121	4.44	625140.	163455.	89.0	26.1						
11	09-13-73	125	3.43	482251.	132783.	82.9	27.5						
12	12-05-73	208	3.86	543007.	11011.	6.4	2.03						
13	12-20-73	223	2.62	367911.	49063.	25.4	13.3						
14	12-25-73	228	2.11	296467.	8051.	4.7	2.72						
15	12-30-73	233	1.88	264401.	13190.	3.5	4.99						
16	12-31-73	234	5.39	757341.	422280.	134.6	55.8						
17	01-20-74	254	2.34	328673.	15006.	3.6	4.57						
18	02-06-74	271	3.66	514457.	127269.	0.0	24.7						
19	02-07-74	272	0.89	125028.	1585.	0.0	1.27						
20	02-14-74	279	1.78	250056.	2043.	0.0	0.82						
21	02-15-74	280	2.49	350050.	94343.	0.0	27.0						
22	04-04-74	328	3.56	500112.	103732.	343.6	20.7						
23	04-13-74	337	2.54	357223.	21278.	20.2	5.96						
TOTAL			66.55	9359379.	2721827.	5892.0	----	--------	2066.1	-------	36718.7	38784.8	----

TABLE E16. PARAQUAT RUNOFF SUMMARY, WATERSHED P4, 1973

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	05-23-73	12	1.22	171439.	2609.	13.5	1.52	34279.7	461.7	0.0	0.0	461.7	0.54
2	05-28-73	17	4.83	678723.	356900.	1609.4	52.6	19852.4	31951.4	0.0	0.0	31951.4	37.7
3	05-28-73	17	4.32	607279.	337259.	1613.2	55.5	15519.0	25035.6	0.0	0.0	25035.6	29.5
4	06-06-73	26	3.94	553696.	280598.	796.2	50.7	14552.5	11586.5	0.0	0.0	11586.5	13.7
5	06-07-73	27	1.12	157234.	80515.	276.3	51.2	13810.9	3815.6	0.0	0.0	3815.6	4.50
6	06-13-73	33	0.89	125028.	16773.	42.6	13.4	12500.0	532.5	0.0	0.0	532.5	0.63
7	07-08-73	58	6.43	903745.	411194.	756.1	45.5	13915.8	10521.6			10521.6	12.4
8	07-14-73	64	1.90	267917.	61563.	59.3	23.0	12918.2	765.8			765.8	0.90
9	07-17-73	67	0.94	132201.	9328.	11.5	7.06	12400.0	142.3			142.3	0.17
10	09-09-73	121	4.44	625140.	163455.	89.0	26.1						
11	09-13-73	125	3.43	482251.	132783.	82.9	27.5						
12	12-05-73	208	3.86	543007.	11011.	6.4	2.03						
13	12-20-73	223	2.62	367911.	49063.	25.4	13.3						
14	12-25-73	228	2.11	296467.	8051.	4.7	2.72						
15	12-30-73	233	1.88	264401.	13190.	3.5	4.99						
16	12-31-73	234	5.39	757341.	422280.	134.6	55.8						
17	01-20-74	254	2.34	328673.	15006.	3.6	4.57						
18	02-06-74	271	3.66	514457.	127269.	0.0	24.7						
19	02-07-74	272	0.89	125028.	1585.	0.0	1.27						
20	02-14-74	279	1.78	250056.	2043.	0.0	0.82						
21	02-15-74	280	2.49	350050.	94343.	0.0	27.0						
22	04-04-74	328	3.56	500112.	103732.	343.6	20.7						
23	04-13-74	337	2.54	357223.	21278.	20.2	5.96						
TOTAL			66.55	9359379.	2721827.	5892.0	----	--------	84813.0	--------	0.0	84813.0	----

TABLE E17. DIPHENAMID RUNOFF SUMMARY, WATERSHED P1, 1974

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	06-20-74	22	1.27	343618.	49719.	623.4	14.5	903.7	563.3	213.2	10598.8	11162.1	44.4
2	06-27-74	29	3.56	962130.	298283.	2193.0	31.0	412.7	905.0	32.4	9659.6	10564.6	42.0
3	06-27-74	29	5.46	1477556.	1309388.	16036.9	88.6	0.0	0.0	0.0	0.0	0.0	0.0
4	07-06-74	38	0.89	240533.	17038.	138.6	7.08	514.0	71.2	15.9	271.5	342.7	1.36
5	07-24-74	56	0.84	227816.	19757.	149.2	8.67	49.4	7.4	3.2	64.0	71.4	0.28
6	07-26-74	58	2.90	783557.	411845.	2635.7	52.6	7.2	19.0	1.5	609.6	628.6	2.50
7	07-27-74	59	8.56	2316038.	2065215.	7039.7	89.2	1.3	9.3	1.1	2366.0	2375.3	9.44
8	08-10-74	73	1.90	515427.	95495.	491.1	18.5	0.0	0.0	0.1	9.1	9.1	0.04
9	08-16-74	79	5.33	1443195.	435056.	792.9	30.1	0.0	0.0	0.0	0.0	0.0	0.0
10	08-17-74	80	1.65	446703.	45662.	56.9	10.2	0.0	0.0	0.0	0.0	0.0	0.0
11	12-15-74	200	3.05	824683.	7511.	5.0	0.91						
12	12-19-74	204	2.16	584151.	2048.	0.8	0.35						
13	12-29-74	214	2.29	618512.	6199.	0.8	1.00						
14	01-10-75	226	2.79	755959.	37257.	31.9	4.93						
15	01-12-75	228	2.54	687236.	48314.	10.9	7.03						
16	01-24-75	240	2.74	742160.	57790.	1.7	7.79						
17	02-04-75	251	3.56	962130.	20480.	0.6	2.13						
18	02-16-75	263	2.41	652874.	16480.	0.5	2.52						
19	02-18-75	265	4.19	1133938.	327375.	142.5	28.9						
20	02-24-75	271	2.79	755959.	58316.	9.4	7.71						
21	03-12-75	287	2.03	549789.	62125.	1.2	11.3						
22	03-13-75	288	10.92	2955114.	1391944.	215.0	47.1						
23	03-16-75	291	1.78	481065.	6060.	0.2	1.26						
24	03-18-75	293	3.94	1065215.	92143.	1.8	8.65						
25	03-24-75	299	2.54	687236.	22091.	0.7	3.21						
26	04-02-75	308	5.84	1580641.	706880.	21.2	44.7						
27	05-07-75	343	4.32	1168300.	35239.	31.6	3.02						
TOTAL			92.26	24961533.	7645707.	30633.2	----	--------	1575.2	-------	23578.6	25153.8	----

TABLE E18. PARAQUAT RUNOFF SUMMARY, WATERSHED P1, 1974

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	06-20-74	22	1.27	343618.	49719.	623.4	14.5	79085.1	49298.7	0.0	0.0	49298.7	4.68
2	06-27-74	29	3.56	962130.	298283.	2193.0	31.0	47129.3	103356.1	0.0	0.0	103356.1	9.82
3	06-27-74	29	5.46	1477556.	1309388.	16036.9	88.6	37372.0	599330.0	0.0	0.0	599330.0	56.9
4	07-06-74	38	0.89	240533.	17038.	138.6	7.08	43158.5	5980.7	0.0	0.0	5980.7	0.57
5	07-24-74	56	0.84	227816.	19757.	149.2	8.67	29001.1	4327.7	0.0	0.0	4327.7	0.41
6	07-26-74	58	2.90	783557.	411845.	2635.7	52.6	30733.1	81002.3	0.0	0.0	81002.3	7.69
7	07-27-74	59	8.56	2316038.	2065215.	7039.7	89.2	24633.8	173415.7			173415.7	16.5
8	08-10-74	73	1.90	515427.	95495.	491.1	18.5	26107.5	12821.6			12821.6	1.22
9	08-16-74	79	5.33	1443195.	435056.	792.9	30.1	27144.5	21521.8	0.0	0.0	21521.8	2.04
10	08-17-74	80	1.65	446703.	45662.	56.9	10.2	33241.0	1891.7	0.0	0.0	1891.7	0.18
11	12-15-74	200	3.05	824683.	7511.	5.0	0.91						
12	12-19-74	204	2.16	584151.	2048.	0.8	0.35						
13	12-29-74	214	2.29	618512.	6199.	0.8	1.00						
14	01-10-75	226	2.79	755959.	37257.	31.9	4.93						
15	01-12-75	228	2.54	687236.	48314.	10.9	7.03						
16	01-24-75	240	2.74	742160.	57790.	1.7	7.79						
17	02-04-75	251	3.56	962130.	20480.	0.6	2.13						
18	02-16-75	263	2.41	652874.	16480.	0.5	2.52						
19	02-18-75	265	4.19	1133938.	327375.	142.5	28.9						
20	02-24-75	271	2.79	755959.	58316.	9.4	7.71						
21	03-12-75	287	2.03	549789.	62125.	1.2	11.3						
22	03-13-75	288	10.92	2955114.	1391944.	215.0	47.1						
23	03-16-75	291	1.78	481065.	6060.	0.2	1.26						
24	03-18-75	293	3.94	1065215.	92143.	1.8	8.65						
25	03-24-75	299	2.54	687236.	22091.	0.7	3.21						
26	04-02-75	308	5.84	1580641.	706880.	21.2	44.7						
27	05-07-75	343	4.32	1168300.	35239.	31.6	3.02						
TOTAL			92.26	24961533.	7645707.	30633.2	----	--------	1052946.3	-------	0.0	1052946.3	----

TABLE E19. ATRAZINE RUNOFF SUMMARY, WATERSHED P2, 1974

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	05-05-74	6	1.88	243071.	2053.	13.1	0.84	4100.0	53.7	1900.0	3900.9	3954.6	41.1
2	05-23-74	24	7.01	906346.	94942.	119.6	10.5	2559.9	306.3	22.4	2130.1	2436.4	25.3
3	06-20-74	52	1.22	157608.	1844.	1.8	1.17	910.0	1.7	20.0	36.9	38.6	0.40
4	06-27-74	59	5.39	696244.	152923.	294.4	22.0	488.4	143.8	2.9	442.3	586.1	6.08
5	06-27-74	59	5.44	702838.	386371.	962.2	55.0	483.3	465.0	2.9	1104.4	1569.4	16.3
6	07-24-74	86	1.47	190449.	19149.	30.4	10.1	250.0	7.6	3.0	57.4	65.0	0.67
7	07-27-74	89	7.21	932721.	587874.	859.6	63.0	235.0	202.0	1.0	607.5	809.5	8.40
8	08-10-74	103	2.85	367839.	28215.	29.3	7.67	0.0	0.0	1.1	30.2	30.2	0.31
9	08-16-74	109	5.00	646984.	106941.	91.9	16.5	0.0	0.0	1.2	125.3	125.3	1.30
10	08-17-74	110	1.52	197043.	16840.	9.5	8.55	0.0	0.0	1.0	16.8	16.8	0.17
11	08-29-74	122	1.52	197043.	6437.	4.9	3.27	0.0	0.0	0.0	0.0	0.0	0.0
12	09-01-74	125	1.14	147782.	7702.	0.7	5.21	0.0	0.0	0.0	0.0	0.0	0.0
13	12-15-74	230	3.10	400680.	661.	0.0	0.17						
14	12-19-74	234	2.16	279144.	321.	0.0	0.11						
15	12-29-74	244	2.29	295564.	909.	0.0	0.31						
16	01-10-75	256	2.64	341593.	6110.	4.0	1.79						
17	01-12-75	258	2.29	295564.	7110.	0.2	2.41						
18	01-24-75	270	2.67	344825.	6383.	0.2	1.85						
19	02-04-75	281	3.56	459767.	20459.	2.8	4.45						
20	02-17-75	294	2.21	285738.	9221.	0.9	3.23						
21	02-18-75	295	2.13	275912.	83134.	8.6	30.1						
22	02-24-75	301	2.79	361245.	7801.	4.9	2.16						
23	03-13-75	318	9.45	1221691.	597288.	75.6	48.9						
24	03-16-75	321	1.78	229883.	6060.	1.1	2.64						
25	03-18-75	323	2.13	275912.	18972.	0.4	6.88						
TOTAL			80.85	10453488.	2175719.	2516.1	----	--------	1180.1	-------	8451.8	9631.9	----

TABLE E20. PARAQUAT RUNOFF SUMMARY, WATERSHED P2, 1974

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	05-05-74	6	1.88	243071.	2053.	13.1	0.84	1470000.7	19255.4	0.0	0.0	19255.4	18.8
2	05-23-74	24	7.01	906346.	94942.	119.6	10.5	34372.1	4112.2	0.0	0.0	4112.2	4.03
3	06-20-74	52	1.22	157608.	1844.	1.8	1.17	53030.0	97.8	0.0	0.0	97.8	0.10
4	06-27-74	59	5.39	696244.	152923.	294.4	22.0	42143.9	12405.4	0.0	0.0	12405.4	12.1
5	06-27-74	59	5.44	702838.	386371.	962.2	55.0	36237.2	34865.7	0.0	0.0	34865.7	34.1
6	07-24-74	86	1.47	190449.	19149.	30.4	10.1	35020.0	1066.2	0.0	0.0	1066.2	1.04
7	07-27-74	89	7.21	932721.	587874.	859.6	63.0	30377.3	26113.1	0.0	0.0	26113.1	25.6
8	08-10-74	103	2.85	367839.	28215.	29.3	7.67	29889.3	876.8	0.0	0.0	876.8	0.86
9	08-16-74	109	5.00	646984.	106941.	91.9	16.5	31657.8	2907.8	0.0	0.0	2907.8	2.85
10	08-17-74	110	1.52	197043.	16840.	9.5	8.55	47901.0	453.0	0.0	0.0	453.0	0.44
11	08-29-74	122	1.52	197043.	6437.	4.9	3.27						
12	09-01-74	125	1.14	147782.	7702.	0.7	5.21						
13	12-15-74	230	3.10	400680.	661.	0.0	0.17						
14	12-19-74	234	2.16	279144.	321.	0.0	0.11						
15	12-29-74	244	2.29	295564.	909.	0.0	0.31						
16	01-10-75	256	2.64	341593.	6110.	4.0	1.79						
17	01-12-75	258	2.29	295564.	7110.	0.2	2.41						
18	01-24-75	270	2.67	344825.	6383.	0.2	1.85						
19	02-04-75	281	3.56	459767.	20459.	2.8	4.45						
20	02-17-75	294	2.21	285738.	9221.	0.9	3.23						
21	02-18-75	295	2.13	275912.	83134.	8.6	30.1						
22	02-24-75	301	2.79	361245.	7801.	4.9	2.16						
23	03-13-75	318	9.45	1221691.	597288.	75.6	48.9						
24	03-16-75	321	1.78	229883.	6060.	1.1	2.64						
25	03-18-75	323	2.13	275912.	18972.	0.4	6.88						
TOTAL			80.85	10453488.	2175719.	2516.1	----	--------	102153.4	-------	0.0	102153.4	----

TABLE E21. DIPHENAMID RUNOFF SUMMARY, WATERSHED P3, 1974

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	06-27-74	28	5.33	672347.	95330.	246.5	14.2	638.9	157.5	21.0	2002.4	2159.9	46.1
2	06-27-74	28	3.30	416215.	137506.	701.7	33.0	174.7	122.6	16.7	2291.4	2414.0	51.5
3	07-27-74	58	7.70	970075.	208000.	677.1	21.4	163.9	111.0	0.0	2.2	113.2	2.42
4	08-14-74	76	1.27	160083.	199.	0.8	0.12	0.0	0.0	0.0	0.0	0.0	0.0
5	08-16-74	78	4.44	560289.	105957.	285.4	18.9	0.0	0.0	0.0	0.0	0.0	0.0
6	08-29-74	91	2.54	320165.	28710.	52.3	8.97						
7	09-01-74	94	1.27	160083.	11423.	21.3	7.14						
8	12-15-74	199	3.12	393778.	608.	1.2	0.15						
9	12-19-74	203	2.16	272140.	3878.	5.2	1.43						
10	12-29-74	213	2.29	288149.	51.	0.1	0.02						
11	01-10-75	225	2.59	326594.	6792.	28.2	2.08						
12	01-12-75	227	3.12	393778.	87554.	94.8	22.2						
13	02-16-75	262	2.62	329745.	8713.	4.4	2.64						
14	02-18-75	264	4.55	573146.	57325.	58.8	10.0						
15	02-24-75	270	2.41	304157.	64501.	122.2	21.2						
16	03-13-75	287	10.01	1261501.	449476.	324.8	35.6						
17	03-16-75	290	1.78	224116.	4384.	1.1	1.96						
18	03-18-75	292	1.09	137646.	1631.	0.5	1.19						
19	03-24-75	298	2.64	333022.	41633.	29.9	12.5						
20	04-02-75	307	6.98	880454.	727230.	384.8	82.6						
TOTAL			71.22	8977482.	2040899.	3041.1	----	--------	391.1	-------	4296.0	4687.1	----

TABLE E22. PARAQUAT RUNOFF SUMMARY, WATERSHED P3, 1974

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	06-27-74	28	5.33	672347.	95330.	246.5	14.2	47756.6	11772.2	0.0	0.0	11772.2	16.1
2	06-27-74	28	3.30	416215.	137506.	701.7	33.0	39756.3	27896.8	0.0	0.0	27896.8	38.1
3	07-27-74	58	7.70	970075.	208000.	677.1	21.4	34323.6	23239.4	0.0	0.0	23239.4	31.8
4	08-14-74	76	1.27	160083.	199.	0.8	0.12	31920.0	24.8	0.0	0.0	24.8	0.03
5	08-16-74	78	4.44	560289.	105957.	285.4	18.9	35885.9	10243.3	0.0	0.0	10243.3	14.0
6	08-29-74	91	2.54	320165.	28710.	52.3	8.97						
7	09-01-74	94	1.27	160083.	11423.	21.3	7.14						
8	12-15-74	199	3.12	393778.	608.	1.2	0.15						
9	12-19-74	203	2.16	272140.	3878.	5.2	1.43						
10	12-29-74	213	2.29	288149.	51.	0.1	0.02						
11	01-10-75	225	2.59	326594.	6792.	28.2	2.08						
12	01-12-75	227	3.12	393778.	87554.	94.8	22.2						
13	02-16-75	262	2.62	329745.	8713.	4.4	2.64						
14	02-18-75	264	4.55	573146.	57325.	58.8	10.0						
15	02-24-75	270	2.41	304157.	64501.	122.2	21.2						
16	03-13-75	287	10.01	1261501.	449476.	324.8	35.6						
17	03-16-75	290	1.78	224116.	4384.	1.1	1.96						
18	03-18-75	292	1.09	137646.	1631.	0.5	1.19						
19	03-24-75	298	2.64	333022.	41633.	29.9	12.5						
20	04-02-75	307	6.98	880454.	727230.	384.8	82.6						
TOTAL			71.22	8977482.	2040899.	3041.1	----	--------	73176.5	-------	0.0	73176.5	----

TABLE E23. ATRAZINE RUNOFF SUMMARY, WATERSHED P4, 1974

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	05-23-74	24	6.88	968018.	26621.	18.3	2.75	568.2	10.4	324.5	8639.5	8649.9	81.0
2	06-27-74	59	5.33	750168.	89498.	90.2	11.9	197.3	17.8	6.8	609.6	627.4	5.88
3	06-27-74	59	3.30	464390.	221440.	345.8	47.7	224.0	77.5	5.4	1189.0	1266.5	11.9
4	07-27-74	89	7.65	1075184.	366917.	121.2	34.1	0.0	0.0	0.2	84.4	84.4	0.79
5	08-16-74	109	4.44	625140.	68908.	41.0	11.0	0.0	0.0	0.7	48.1	48.1	0.45
6	08-29-74	122	2.54	357223.	5024.	2.7	1.41						
7	12-15-74	230	3.18	446529.	674.	0.7	0.15						
8	12-19-74	234	2.16	303640.	491.	2.6	0.16						
9	12-29-74	244	2.29	321501.	7078.	5.2	2.20						
10	01-10-75	256	2.46	346534.	36758.	72.1	10.6						
11	01-12-75	258	3.12	439356.	112355.	114.0	25.6						
12	01-24-75	270	1.27	178612.	45262.	42.1	25.3						
13	02-04-75	281	0.0 *	0.*	71502.	33.5							
14	02-16-75	293	2.62	367911.	5429.	3.8	1.48						
15	02-16-75	293	1.52	214334.	12967.	9.5	6.05						
16	02-18-75	295	4.42	621624.	179207.	146.6	28.8						
17	02-24-75	301	2.41	339362.	69050.	51.8	20.3						
18	03-13-75	318	10.01	1407514.	769875.	434.2	54.7						
19	03-16-75	321	1.78	250056.	12630.	5.8	5.05						
20	03-18-75	323	2.82	396461.	95711.	30.7	24.1						
21	03-24-75	329	2.64	371568.	41617.	20.4	11.2						
TOTAL			72.85	10245123.	2239013.	1592.2	----	--------	105.7	-------	10570.6	10676.3	----

* ---- RAIN GAUGE STOPPED

TABLE E24. PARAQUAT RUNOFF SUMMARY, WATERSHED P4, 1974

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	05-23-74	24	6.88	968018.	26621.	18.3	2.75	150.0	2.8			2.8	0.01
2	06-27-74	59	5.33	750168.	89498.	90.2	11.9	49279.9	4446.9	0.0	0.0	4446.9	18.0
3	06-27-74	59	3.30	464390.	221440.	345.8	47.7	39452.5	13641.1	0.0	0.0	13641.1	55.1
4	07-27-74	89	7.65	1075184.	366917.	121.2	34.1	40597.1	4920.7	0.0	0.0	4920.7	19.9
5	08-16-74	109	4.44	625140.	68908.	41.0	11.0	42936.6	1759.2	0.0	0.0	1759.2	7.10
6	08-29-74	122	2.54	357223.	5024.	2.7	1.41						
7	12-15-74	230	3.18	446529.	674.	0.7	0.15						
8	12-19-74	234	2.16	303640.	491.	2.6	0.16						
9	12-29-74	244	2.29	321501.	7078.	5.2	2.20						
10	01-10-75	256	2.46	346534.	36758.	72.1	10.6						
11	01-12-75	258	3.12	439356.	112355.	114.0	25.6						
12	01-24-75	270	1.27	178612.	45262.	42.1	25.3						
13	02-04-75	281	0.0 *	0.*	71502.	33.5							
14	02-16-75	293	2.62	367911.	5429.	3.8	1.48						
15	02-16-75	293	1.52	214334.	12967.	9.5	6.05						
16	02-18-75	295	4.42	621624.	179207.	146.6	28.8						
17	02-24-75	301	2.41	339362.	69050.	51.8	20.3						
18	03-13-75	318	10.01	1407514.	769875.	434.2	54.7						
19	03-16-75	321	1.78	250056.	12630.	5.8	5.05						
20	03-18-75	323	2.82	396461.	95711.	30.7	24.1						
21	03-24-75	329	2.64	371568.	41617.	20.4	11.2						
TOTAL			72.85	10245123.	2239013.	1592.2	----	--------	24767.9	-------	0.0	24770.7	----

* ---- RAIN GAUGE STOPPED

TABLE E25. PARAQUAT RUNOFF SUMMARY, WATERSHED P1, 1975

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	06-11-75	9	4.70	1271386.	683601.	41.3	53.8	976030.2	40336.2			40336.2	98.9
2	07-13-75	41	2.54	687236.	4694.	3.3	0.68	132000.2	439.9			439.9	1.08
3	07-24-75	52	4.32	1168300.	25789.	1.2	2.21						
4	09-17-75	107	5.08	1374471.	12481.	1.3	0.91						
5	09-22-75	112	3.63	982693.	1283.	0.1	0.13						
TOTAL			20.27	5484086.	727848.	47.2	----	--------	40776.1	-------		40776.1	----

TABLE E26. PROPAZINE RUNOFF SUMMARY, WATERSHED P1, 1975

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	06-11-75	9	4.70	1271386.	683601.	41.3	53.8	21776.8	900.0	400.7	273917.0	274817.0	99.8
2	07-13-75	41	2.54	687236.	4694.	3.3	0.68	0.0	0.0	20.0	93.9	93.9	0.03
3	07-24-75	52	4.32	1168300.	25789.	1.2	2.21			15.8	407.0	407.0	0.15
4	09-17-75	107	5.08	1374471.	12481.	1.3	0.91						
5	09-22-75	112	3.63	982693.	1283.	0.1	0.13						
TOTAL			20.27	5484086.	727848.	47.2	----	--------	900.0	-------	274417.9	275317.9	----

TABLE E27. ATRAZINE RUNOFF SUMMARY, WATERSHED P2, 1975

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	05-31-75	10	3.61	466361.	51767.	280.6	11.1	1534.4	430.6	101.3	5245.9	5676.5	40.7
2	06-11-75	21	2.41	311985.	95552.	383.5	30.6	986.6	378.4	16.5	1578.1	1956.5	14.0
3	06-11-75	21	4.70	607549.	432969.	4975.7	71.3	298.6	1486.0	10.2	4409.7	5895.7	42.3
4	06-19-75	29	0.63	82101.	13898.	2.8	16.9	39.2	0.1	11.9	165.4	165.5	1.19
5	07-13-75	53	2.67	344825.	104437.	416.8	30.3	38.3	16.0	1.0	107.2	123.2	0.88
6	07-24-75	64	4.32	558288.	313363.	556.3	56.1	0.0	0.0	0.4	119.0	119.0	0.85
7	08-01-75	72	0.89	114942.	15140.	9.7	13.2	25.9	0.2	0.2	3.3	3.5	0.03
8	09-17-75	119	5.08	656810.	72527.	86.7	11.0						
9	09-23-75	125	1.14	147782.	12422.	7.6	8.41						
TOTAL			25.45	3290643.	1112076.	6719.7	----	--------	2311.3	-------	11628.6	13939.9	----

TABLE E28. CYANAZINE RUNOFF SUMMARY, WATERSHED P2, 1975

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	05-31-75	10	3.61	466361.	51767.	280.6	11.1	2337.1	655.9	181.0	9370.9	10026.8	48.0
2	06-11-75	21	2.41	311985.	95552.	383.5	30.6	1096.3	420.4	30.8	2944.1	3364.5	16.1
3	06-11-75	21	4.70	607549.	432969.	4975.7	71.3	331.1	1647.5	12.5	5397.9	7045.4	33.8
4	06-19-75	29	0.63	82101.	13898.	2.8	16.9	38.4	0.1	14.4	200.1	200.2	0.96
5	07-13-75	53	2.67	344825.	104437.	416.8	30.3	0.0	0.0	1.1	119.8	119.8	0.57
6	07-24-75	64	4.32	558288.	313363.	556.3	56.1	0.0	0.0	0.4	117.7	117.7	0.56
7	08-01-75	72	0.89	114942.	15140.	9.7	13.2	0.0	0.0	0.0	0.0	0.0	0.0
8	09-17-75	119	5.08	656810.	72527.	86.7	11.0						
9	09-23-75	125	1.14	147782.	12422.	7.6	8.41						
TOTAL			25.45	3290643.	1112076.	6719.7	----	--------	2723.9	-------	18150.5	20874.4	----

TABLE E29. PARAQUAT RUNOFF SUMMARY, WATERSHED P2, 1975

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	05-31-75	10	3.61	466361.	51767.	280.6	11.1	72237.0	20271.8			20271.8	8.57
2	06-11-75	21	2.13	275265.	95552.	383.5	34.7	38437.9	14741.7			14741.7	6.23
3	06-11-75	21	4.70	607549.	432969.	4975.7	71.3	35378.0	176030.5	0.0	0.0	176030.5	74.4
4	06-19-75	29	0.63	82101.	13898.	2.8	16.9	35500.0	98.7			98.7	0.04
5	07-13-75	53	2.67	344825.	104437.	416.8	30.3	19592.6	8166.8			8166.8	3.45
6	07-24-75	64	4.32	558288.	313363.	556.3	56.1	31086.6	17293.7			17293.7	7.31
7	08-01-75	72	0.89	114942.	15140.	9.7	13.2						
8	09-17-75	119	5.08	656810.	72527.	86.7	11.0						
9	09-23-75	125	1.14	147782.	12422.	7.6	8.41						
TOTAL			25.17	3253923.	1112076.	6719.7	----	--------	236603.2	-------	0.0	236603.2	----

TABLE E30. 2,4-D RUNOFF SUMMARY, WATERSHED P2, 1975

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	05-31-75	10	3.61	466361.	51767.	280.6	11.1	2136.1	599.5	298.0	15428.0	16027.5	72.9
2	06-11-75	21	2.13	275265.	95552.	383.5	34.7	131.9	50.6			50.6	0.23
3	06-11-75	21	4.70	607549.	432969.	4975.7	71.3	270.4	1345.5	9.3	4047.4	5392.9	24.5
4	06-19-75	29	0.63	82101.	13898.	2.8	16.9	0.0	0.0	0.5	6.9	6.9	0.03
5	07-13-75	53	2.67	344825.	104437.	416.8	30.3	178.9	74.6	3.7	385.7	460.3	2.09
6	07-24-75	64	4.32	558288.	313363.	556.3	56.1	0.0	0.0	0.2	59.0	59.0	0.27
7	08-01-75	72	0.89	114942.	15140.	9.7	13.2	0.0	0.0	0.0	0.0	0.0	0.0
8	09-17-75	119	5.08	656810.	72527.	86.7	11.0						
9	09-23-75	125	1.14	147782.	12422.	7.6	8.41						
TOTAL			25.17	3253923.	1112076.	6719.7	----	--------	2070.2	-------	19927.0	21997.2	----

TABLE E31. DIPHENAMID RUNOFF SUMMARY, WATERSHED P3, 1975

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	06-11-75	14	2.67	336174.	33841.	92.5	10.1	839.9	77.7	40.4	1365.7	1443.4	19.9
2	06-11-75	14	2.54	320165.	76948.	212.1	24.0	838.6	177.9	73.4	5648.6	5826.5	80.1
3	07-24-75	57	2.16	272140.	5162.	10.3	1.90						
4	09-23-75	118	4.88	614742.	11153.	4.5	1.81						
TOTAL			12.24	1543222.	127103.	319.4	----	--------	255.6	-------	7014.3	7269.9	----

TABLE E32. PARAQUAT RUNOFF SUMMARY, WATERSHED P3, 1975

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	06-11-75	14	2.67	336174.	33841.	92.5	10.1	61334.8	5672.4			5672.4	27.6
2	06-11-75	14	2.54	320165.	76948.	212.1	24.0	69984.3	14847.1			14847.1	72.4
3	07-24-75	57	2.16	272140.	5162.	10.3	1.90						
4	09-23-75	118	4.88	614742.	11153.	4.5	1.81						
TOTAL			12.24	1543222.	127103.	319.4	----	--------	20519.5	-------		20519.5	----

TABLE E33. ATRAZINE RUNOFF SUMMARY, WATERSHED P4, 1975

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	05-31-75	17	3.56	500112.	42140.	107.1	8.43	599.5	64.2	34.8	1467.3	1531.5	29.0
2	06-11-75	28	2.67	375084.	212819.	557.4	56.7	319.2	177.9	4.8	1023.2	1201.1	22.8
3	06-11-75	28	2.54	357223.	88218.	187.4	24.7	243.7	45.7	28.3	2500.3	2546.0	48.2
4	09-17-75	126	3.43	482251.	8570.	6.2	1.78						
5	09-23-75	132	4.88	685896.	138125.	81.5	20.1						
TOTAL			17.07	2400566.	489872.	939.6	----	--------	287.8	-------	4990.8	5278.6	----

TABLE E34. CYANAZINE RUNOFF SUMMARY, WATERSHED P4, 1975

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	05-31-75	17	3.56	500112.	42140.	107.1	8.43	247.5	26.5	12.1	511.7	538.2	39.1
2	06-11-75	28	2.67	375084.	212819.	557.4	56.7	194.3	108.3	2.0	428.3	536.6	38.9
3	06-11-75	28	2.54	357223.	88218.	187.4	24.7	138.6	26.0	3.1	277.3	303.3	22.0
4	09-17-75	126	3.43	482251.	8570.	6.2	1.78						
5	09-23-75	132	4.88	685896.	138125.	81.5	20.1						
TOTAL			17.07	2400566.	489872.	939.6	----	--------	160.8	-------	1217.3	1378.1	----

TABLE E35. PARAQUAT RUNOFF SUMMARY, WATERSHED P4, 1975

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	05-31-75	17	3.56	500112.	42140.	107.1	8.43	85597.4	9168.7	0.0	0.0	9168.7	19.2
2	06-11-75	28	2.67	375084.	212819.	557.4	56.7	52373.6	29194.2			29194.2	61.3
3	06-11-75	28	2.54	357223.	88218.	187.4	24.7	49595.6	9294.1			9294.1	19.5
4	09-17-75	126	3.43	482251.	8570.	6.2	1.78						
5	09-23-75	132	4.88	685896.	138125.	81.5	20.1						
TOTAL			17.07	2400566.	489872.	939.6	----	--------	47657.0	-------	0.0	47657.0	----

TABLE E36. 2,4-D RUNOFF SUMMARY, WATERSHED P4, 1975

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. PESTICIDE IN SED. (PPB)	TOTAL PESTICIDE IN SED. (MG)	MN. CONC. PESTICIDE IN WATER (PPB)	TOTAL PESTICIDE IN WATER (MG)	TOTAL AMOUNT OF PESTICIDE (MG)	% OF SEASON TOTAL LOSS
1	05-31-75	17	3.56	500112.	42140.	107.1	8.43	29.8	3.2	0.6	26.9	30.1	20.1
2	06-11-75	28	2.67	375084.	212819.	557.4	56.7	7.4	4.1	0.0	5.8	9.9	6.60
3	06-11-75	28	2.54	357223.	88218.	187.4	24.7	0.0	0.0	1.2	110.0	110.0	73.3
4	09-17-75	126	3.43	482251.	8570.	6.2	1.78						
5	09-23-75	132	4.88	685896.	138125.	81.5	20.1						
TOTAL			17.07	2400566.	489872.	939.6	----	--------	7.3	-------	142.7	150.0	----

TABLE F1. CHLORIDE REMAINING IN SOIL PROFILE, WATERSHED P2, 1974

	1			2			3		
DATE	04-19-74			04-29-74			05-02-74		
DAYS AFTER PLANTING	-10			0			3		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	31	26351.6	41605.	10	77930.0	123040.	2	375900.0	593492.
ZONE 2 3- 6"	31	22764.5	35942.	10	103500.0	163411.	2	20050.0	31656.
ZONE 3 6-12"	31	42619.4	134580.	0			0		
ZONE 4 12-18"	31	26464.5	83567.	0			0		
ZONE 5 18-24"	31	20000.0	63154.	0			0		
ZONE 6 24-36"	31	27364.5	172818.	0			0		
ZONE 7 36-48"	31	35264.5	222710.	0			0		
ZONE 8 48-60"	31	32597.8	205869.	0			0		

TABLE F1 (continued). CHLORIDE REMAINING IN SOIL PROFILE, WATERSHED P2, 1974

	4			5			6		
DATE	05-08-74			05-09-74			05-14-74		
DAYS AFTER PLANTING	9			10			15		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	11	102554.5	161919.	2	132000.0	208409.	6	80450.0	127019.
ZONE 2 3- 6"	11	42445.5	67015.	2	43000.0	67891.	6	52900.0	83521.
ZONE 3 6-12"	11	22327.3	70503.	2	44600.0	140834.	6	29550.0	93310.
ZONE 4 12-18"	11	21481.8	67833.	2	45550.0	143834.	6	31800.0	100415.
ZONE 5 18-24"	11	26763.6	84512.	2	22000.0	69470.	6	39016.7	123203.
ZONE 6 24-36"	0			0			1	41500.0	262090.
ZONE 7 36-48"	0			0			1	2500.0	15789.
ZONE 8 48-60"	0			0			1	1100.0	6947.

TABLE F1 (continued). CHLORIDE REMAINING IN SOIL PROFILE, WATERSHED P2, 1974

	7			8			9		
DATE	05-20-74			06-05-74			07-08-74		
DAYS AFTER PLANTING	21			37			70		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	32	54706.2	86373.	30	71623.3	113083.	31	28074.2	44325.
ZONE 2 3- 6"	32	26959.4	42565.	30	35320.0	55765.	31	23806.4	37587.
ZONE 3 6-12"	32	36746.9	116036.	30	23986.7	75743.	31	19174.2	60547.
ZONE 4 12-18"	31	23854.8	75327.	30	10233.3	32314.	31	23719.4	74899.
ZONE 5 18-24"	30	40676.7	128445.	30	11400.0	35998.	31	28164.5	88935.
ZONE 6 24-36"	30	49573.3	313076.	30	19023.3	120140.	31	33100.0	209040.
ZONE 7 36-48"	29	67134.4	423982.	30	26870.0	169695.	31	34054.8	215071.
ZONE 8 48-60"	29	40217.2	253989.	30	26930.0	170074.	31	37732.3	238295.

TABLE F1 (continued). CHLORIDE REMAINING IN SOIL PROFILE, WATERSHED P2, 1974

	10		
DATE	10-30-74		
DAYS AFTER PLANTING	184		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	34	22055.9	34823.
ZONE 2 3- 6"	34	18785.3	29659.
ZONE 3 6-12"	34	18276.5	57712.
ZONE 4 12-18"	34	18494.1	58399.
ZONE 5 18-24"	34	20526.5	64817.
ZONE 6 24-36"	34	28285.3	178634.
ZONE 7 36-48"	34	37123.5	234451.
ZONE 8 48-60"	34	40702.9	257056.

TABLE F2. NITRATE-N REMAINING IN SOIL PROFILE, WATERSHED P2, 1974

	1			2			3		
DATE	04-19-74			04-29-74			05-02-74		
DAYS AFTER PLANTING	-10			0			3		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	31	1238.7	1956.	10	2610.0	4121.	2	6800.0	10736.
ZONE 2 3- 6"	31	1193.5	1884.	10	2200.0	3473.	2	1700.0	2684.
ZONE 3 6-12"	31	2461.3	7772.	0			0		
ZONE 4 12-18"	31	4935.5	15585.	0			0		
ZONE 5 18-24"	31	6441.9	20342.	0			0		
ZONE 6 24-36"	31	7758.1	48995.	0			0		
ZONE 7 36-48"	31	10238.7	64662.	0			0		
ZONE 8 48-60"	31	9641.9	60893.	0			0		

TABLE F2 (continued). NITRATE-N REMAINING IN SOIL PROFILE, WATERSHED P2, 1974

	4			5			6		
DATE	05-08-74			05-09-74			05-14-74		
DAYS AFTER PLANTING	9			10			15		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	11	10127.3	15989.	2	19650.0	31024.	6	19983.3	31551.
ZONE 2 3- 6"	11	6363.6	10047.	2	4600.0	7263.	6	6383.3	10078.
ZONE 3 6-12"	11	2618.2	8267.	2	2400.0	7579.	6	2683.3	8473.
ZONE 4 12-18"	11	2109.1	6660.	2	2950.0	9315.	6	3316.7	10473.
ZONE 5 18-24"	11	3727.3	11770.	2	5750.0	18157.	6	4100.0	12947.
ZONE 6 24-36"	0			0			1	5000.0	31577.
ZONE 7 36-48"	0			0			1	16300.0	102941.
ZONE 8 48-60"	0			0			1	15500.0	97889.

TABLE F2 (continued). NITRATE-N REMAINING IN SOIL PROFILE, WATERSHED P2, 1974

	7			8			9		
DATE	05-20-74			06-05-74			07-08-74		
DAYS AFTER PLANTING	21			37			70		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	32	17700.0	27946.	31	10790.3	17036.	31	34758.1	54878.
ZONE 2 3- 6"	32	7681.2	12128.	31	7074.2	11169.	31	10496.8	16573.
ZONE 3 6-12"	32	4800.0	15157.	31	6490.3	20495.	31	4912.9	15514.
ZONE 4 12-18"	32	4215.6	13312.	31	4800.0	15157.	31	5467.7	17266.
ZONE 5 18-24"	31	4564.5	14413.	31	5148.4	16257.	31	6845.2	21615.
ZONE 6 24-36"	31	6809.7	43006.	31	7641.9	48262.	31	8690.3	54883.
ZONE 7 36-48"	31	10119.4	63908.	31	8883.9	56105.	31	8693.8	54905.
ZONE 8 48-60"	31	11041.9	69734.	31	9554.8	60343.	31	10025.8	63317.

TABLE F2 (continued). NITRATE-N REMAINING IN SOIL PROFILE, WATERSHED P2, 1974

	10		
DATE	10-30-74		
DAYS AFTER PLANTING	184		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	34	8935.3	14108.
ZONE 2 3- 6"	34	5967.6	9422.
ZONE 3 6-12"	34	3355.9	10597.
ZONE 4 12-18"	34	2752.9	8693.
ZONE 5 18-24"	34	3361.8	10615.
ZONE 6 24-36"	34	6026.5	38060.
ZONE 7 36-48"	34	8579.4	54183.
ZONE 8 48-60"	34	10176.5	64269.

TABLE F3. TOTAL KJELDAHL NITROGEN REMAINING IN SOIL PROFILE, WATERSHED P2, 1974

	1			2			3		
DATE	04-19-74			04-29-74			05-05-74		
DAYS AFTER PLANTING	-10			0			6		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	27	418888.9	661365.	9	283333.3	447342.	1	430000.0	678908.
ZONE 2 3- 6"	27	381851.8	602869.	9	268888.9	424537.	1	300000.0	473656.
ZONE 3 6-12"	27	311111.1	982398.	0			1	140000.0	442079.
ZONE 4 12-18"	27	136296.2	430384.	0			0		
ZONE 5 18-24"	27	74814.8	236244.	0			0		
ZONE 6 24-36"	27	61851.9	390620.	0			0		
ZONE 7 36-48"	27	59629.6	376586.	0			0		
ZONE 8 48-60"	27	63703.7	402316.	0			0		

TABLE F3 (continued). TOTAL KJELDAHL NITROGEN REMAINING IN SOIL PROFILE, WATERSHED P2, 1974

	4			5			6		
DATE	05-20-74			06-06-74			07-08-74		
DAYS AFTER PLANTING	21			38			70		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	32	495000.0	781533.	31	362903.2	572971.	32	530625.0	837779.
ZONE 2 3- 6"	32	358437.5	565921.	31	280967.7	443607.	32	418437.5	660652.
ZONE 3 6-12"	32	272187.5	859489.	31	219677.4	693677.	32	273125.0	862449.
ZONE 4 12-18"	32	125625.0	396687.	31	81612.9	257710.	32	163750.0	517075.
ZONE 5 18-24"	32	79687.5	251630.	31	70967.7	224095.	32	75625.0	238802.
ZONE 6 24-36"	32	63437.5	400635.	31	62580.6	395223.	32	71562.5	451947.
ZONE 7 36-48"	32	75937.5	479577.	31	63225.8	399298.	32	73437.5	463789.
ZONE 8 48-60"	32	76562.5	483524.	31	64838.7	409484.	31	77741.9	490973.

TABLE F3 (continued). TOTAL KJELDAHL NITROGEN REMAINING IN SOIL PROFILE, WATERSHED P2, 1974

	7		
DATE	10-30-74		
DAYS AFTER PLANTING	184		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	34	660588.2	1042973.
ZONE 2 3- 6"	34	838823.5	1324380.
ZONE 3 6-12"	34	443235.2	1399608.
ZONE 4 12-18"	34	272941.1	861869.
ZONE 5 18-24"	34	171176.4	540526.
ZONE 6 24-36"	34	84411.7	533096.
ZONE 7 36-48"	34	32058.8	202465.
ZONE 8 48-60"	34	23823.5	150456.

292

TABLE F4. NITRATE-N REMAINING IN SOIL PROFILE, WATERSHED P4, 1974

	1			2			3		
DATE	04-19-74			04-29-74			05-06-74		
DAYS AFTER PLANTING	-10			0			7		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	20	3450.0	5787.	11	4010.0	6727.	11	6809.1	11422.
ZONE 2 3- 6"	20	1615.0	2709.	11	2346.4	3936.	11	11218.2	18819.
ZONE 3 6-12"	20	1230.0	4127.	0			11	2427.3	8144.
ZONE 4 12-18"	20	1415.0	4747.	0			0		
ZONE 5 18-24"	19	1694.7	5686.	0			0		
ZONE 6 24-36"	19	4568.4	30655.	0			0		
ZONE 7 36-48"	19	8415.8	56471.	0			0		
ZONE 8 48-60"	18	8888.9	59646.	0			0		

TABLE F4 (continued). NITRATE-N REMAINING IN SOIL PROFILE, WATERSHED P4, 1974

	4			5			6		
DATE	05-21-74			06-06-74			06-21-74		
DAYS AFTER PLANTING	22			38			53		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	21	13804.8	23158.	21	9790.5	16424.	11	29945.5	50234.
ZONE 2 3- 6"	21	5471.4	9178.	21	6285.7	10544.	11	5890.9	9882.
ZONE 3 6-12"	21	2057.1	6902.	21	6171.4	20706.	10	5450.0	18285.
ZONE 4 12-18"	21	1790.5	6007.	21	4709.5	15801.	0		
ZONE 5 18-24"	21	1585.7	5320.	21	2852.4	9570.	0		
ZONE 6 24-36"	21	7400.0	49655.	21	2923.8	19619.	0		
ZONE 7 36-48"	21	12128.6	81384.	21	8109.5	54416.	0		
ZONE 8 48-60"	21	11004.8	73843.	21	11738.1	78764.	0		

TABLE F4 (continued). NITRATE-N REMAINING IN SOIL PROFILE, WATERSHED P4, 1974

	7		
DATE	10-30-74		
DAYS AFTER PLANTING	184		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	18	686111.1	1150974.
ZONE 2 3- 6"	18	575000.0	964581.
ZONE 3 6-12"	18	296111.1	993472.
ZONE 4 12-18"	18	152777.7	512580.
ZONE 5 18-24"	18	46111.1	154706.
ZONE 6 24-36"	18	9444.4	63373.
ZONE 7 36-48"	18	9444.4	63373.
ZONE 8 48-60"	18	9444.4	63373.

TABLE F5. CHLORIDE REMAINING IN SOIL PROFILE, WATERSHED P4, 1974

	1			2			3		
DATE	04-19-74			04-29-74			05-06-74		
DAYS AFTER PLANTING	-10			0			7		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	20	33940.0	56935.	11	74309.1	124656.	11	122163.6	204933.
ZONE 2 3- 6"	20	29620.0	49688.	11	47581.8	79820.	11	40127.3	67315.
ZONE 3 6-12"	20	11980.0	40194.	0			11	23427.3	78600.
ZONE 4 12-18"	20	9630.0	32309.	0			0		
ZONE 5 18-24"	19	12878.9	43210.	0			0		
ZONE 6 24-36"	19	14952.6	100334.	0			0		
ZONE 7 36-48"	19	18900.0	126822.	0			0		
ZONE 8 48-60"	18	19538.9	131109.	0			0		

TABLE F5 (continued). CHLORIDE REMAINING IN SOIL PROFILE, WATERSHED P4, 1974

	4			5			6		
DATE	05-21-74			06-06-74			06-21-74		
DAYS AFTER PLANTING	22			38			53		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	21	53261.9	89349.	21	50438.1	84612.	11	35545.5	59629.
ZONE 2 3- 6"	21	30066.7	50438.	21	49419.0	82902.	11	18100.0	30363.
ZONE 3 6-12"	21	14947.6	50150.	21	26104.8	87583.	10	22940.0	76965.
ZONE 4 12-18"	21	14376.2	48233.	21	15452.4	51844.	0		
ZONE 5 18-24"	21	18647.6	62564.	21	11180.9	37513.	0		
ZONE 6 24-36"	21	22261.9	149380.	21	12090.5	81129.	0		
ZONE 7 36-48"	21	27595.2	185168.	21	15900.0	106691.	0		
ZONE 8 48-60"	21	25857.1	173505.	21	20123.8	135033.	0		

TABLE F5 (continued). CHLORIDE REMAINING IN SOIL PROFILE, WATERSHED P4, 1974

	7			8		
DATE	07-08-74			10-30-74		
DAYS AFTER PLANTING	70			184		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	21	18509.5	31050.	21	24366.7	40876.
ZONE 2 3- 6"	21	19700.0	33047.	21	16604.8	27855.
ZONE 3 6-12"	21	16438.1	55151.	21	17666.7	59273.
ZONE 4 12-18"	21	14952.4	50166.	21	20509.5	68811.
ZONE 5 18-24"	21	19447.6	65248.	21	21061.9	70664.
ZONE 6 24-36"	21	18657.1	125192.	21	23152.4	155356.
ZONE 7 36-48"	21	24961.9	167498.	21	24942.9	167370.
ZONE 8 48-60"	21	27552.4	184880.	21	33290.5	223384.

TABLE F6. TOTAL KJELDAHL NITROGEN REMAINING IN SOIL PROFILE, WATERSHED P4, 1974

	1			2			3		
DATE	04-19-74			04-29-74			05-06-74		
DAYS AFTER PLANTING	-10			0			7		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	7	474285.7	795629.	11	548181.8	919593.	10	478000.0	801860.
ZONE 2 3- 6"	7	320000.0	536811.	11	328181.8	550536.	10	327000.0	548553.
ZONE 3 6-12"	7	112857.1	378643.	0			8	150000.0	503260.
ZONE 4 12-18"	7	74285.7	249233.	0			0		
ZONE 5 18-24"	7	70000.0	234855.	0			0		
ZONE 6 24-36"	7	62857.1	421780.	0			0		
ZONE 7 36-48"	7	60000.0	402608.	0			0		
ZONE 8 48-60"	7	62857.1	421780.	0			0		

TABLE F6 (continued). TOTAL KJELDAHL NITROGEN REMAINING IN SOIL PROFILE, WATERSHED P4, 1974

	4			5			6		
DATE	05-21-74			06-06-74			07-08-74		
DAYS AFTER PLANTING	22			38			70		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	21	648095.2	1087200.	21	534761.9	897080.	22	736818.1	1236036.
ZONE 2 3- 6"	21	441904.7	741310.	21	419047.6	702966.	22	525454.5	881467.
ZONE 3 6-12"	21	120952.4	405803.	21	181904.7	610303.	22	93181.8	312631.
ZONE 4 12-18"	21	89047.6	298761.	21	85714.2	287577.	22	80000.0	268405.
ZONE 5 18-24"	21	70000.0	234855.	21	74285.7	249233.	22	61818.2	207404.
ZONE 6 24-36"	21	63809.5	428170.	21	61904.8	415389.	22	82272.7	552061.
ZONE 7 36-48"	21	61428.6	412194.	21	59523.8	399413.	22	65000.0	436159.
ZONE 8 48-60"	21	62857.1	421780.	21	64285.7	431366.	22	60454.5	405658.

TABLE F6 (continued). TOTAL KJELDAHL NITROGEN REMAINING IN SOIL PROFILE, WATERSHED P4, 1974

	7			8		
DATE	07-08-74			10-30-74		
DAYS AFTER PLANTING	70			184		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	21	28695.2	48137.	19	6336.8	10630.
ZONE 2 3- 6"	21	11857.1	19891.	20	5325.0	8933.
ZONE 3 6-12"	21	8666.7	29077.	20	5590.0	18755.
ZONE 4 12-18"	21	6485.7	21760.	20	3355.0	11256.
ZONE 5 18-24"	21	4438.1	14890.	20	1920.0	6442.
ZONE 6 24-36"	21	6723.8	45118.	20	4095.0	27478.
ZONE 7 36-48"	21	9666.7	64865.	20	9345.0	62706.
ZONE 8 48-60"	21	16819.0	112858.	20	10955.0	73510.

TABLE F7. CHLORIDE REMAINING IN SOIL PROFILE, WATERSHED P2, 1975

	1			2			3		
DATE	04-22-75			06-10-75			06-16-75		
DAYS AFTER PLANTING	-29			20			26		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	32	20718.7	32712.	32	32093.7	50671.	2	29300.0	46260.
ZONE 2 3- 6"	32	22043.7	34804.	32	20087.5	31715.	2	30550.0	48234.
ZONE 3 6-12"	32	22253.1	70269.	32	13268.7	41899.	2	30300.0	95679.
ZONE 4 12-18"	32	14003.1	44218.	32	12859.4	40606.	2	20600.0	65049.
ZONE 5 18-24"	31	22461.3	70926.	32	15153.1	47849.	2	13600.0	42945.
ZONE 6 24-36"	32	27696.9	174917.	32	25606.2	161714.	2	14100.0	89047.
ZONE 7 36-48"	32	35437.5	223803.	32	35631.2	225026.	2	31750.0	200515.
ZONE 8 48-60"	32	36687.5	231697.	32	35287.5	222855.	2	37350.0	235881.

TABLE F7 (continued). CHLORIDE REMAINING IN SOIL PROFILE, WATERSHED P2, 1975

	4			5			6		
DATE	06-23-75			07-08-75			07-21-75		
DAYS AFTER PLANTING	33			48			61		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	31	34848.4	55021.	2	1000.0	1579.	31	22780.6	35967.
ZONE 2 3- 6"	31	29051.6	45868.	2	19850.0	31340.	31	26496.8	41835.
ZONE 3 6-12"	31	26919.4	85004.	2	15550.0	49102.	31	20480.6	64672.
ZONE 4 12-18"	31	18696.8	59039.	2	7500.0	23683.	31	15125.8	47763.
ZONE 5 18-24"	31	20538.7	64855.	2	9850.0	31103.	31	24116.1	76152.
ZONE 6 24-36"	31	26893.5	169844.	2	25050.0	158201.	31	21858.1	138043.
ZONE 7 36-48"	31	39725.8	250885.	2	54400.0	343559.	31	33583.9	212096.
ZONE 8 48-60"	31	40903.2	258321.	2	46450.0	293351.	31	36490.3	230452.

TABLE F7 (continued). CHLORIDE REMAINING IN SOIL PROFILE, WATERSHED P2, 1975

	7			8			9		
DATE	08-13-75			09-05-75			10-30-75		
DAYS AFTER PLANTING	84			107			162		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	2	19350.0	30551.	2	14700.0	23209.	32	16818.7	26554.
ZONE 2 3- 6"	2	18550.0	29288.	2	7100.0	11210.	32	15281.2	24127.
ZONE 3 6-12"	2	21300.0	67259.	2	18200.0	57470.	32	13556.2	42807.
ZONE 4 12-18"	2	20100.0	63470.	2	23050.0	72785.	32	19921.9	62908.
ZONE 5 18-24"	2	15550.0	49102.	2	12150.0	38366.	32	19581.2	61832.
ZONE 6 24-36"	2	11750.0	74206.	2	10700.0	67575.	32	27409.4	173102.
ZONE 7 36-48"	2	24500.0	154728.	2	29700.0	187568.	32	35412.5	223645.
ZONE 8 48-60"	2	39950.0	252301.	2	42900.0	270932.	32	35550.0	224513.

TABLE F8. NITRATE-N REMAINING IN SOIL PROFILE, WATERSHED P2, 1975

	1			2			3		
DATE	04-22-75			06-10-75			06-16-75		
DAYS AFTER PLANTING	-29			20			26		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	32	1734.4	2738.	32	11271.9	17797.	2	6500.0	10263.
ZONE 2 3- 6"	32	1328.1	2097.	32	7696.9	12152.	2	7100.0	11210.
ZONE 3 6-12"	32	1587.5	5013.	32	5784.4	18265.	2	6750.0	21315.
ZONE 4 12-18"	32	1243.7	3927.	32	4112.5	12986.	2	7050.0	22262.
ZONE 5 18-24"	32	2550.0	8052.	32	3465.6	10943.	2	3200.0	10105.
ZONE 6 24-36"	32	4175.0	26367.	32	5340.6	33728.	2	1050.0	6631.
ZONE 7 36-48"	32	6531.2	41248.	32	8115.6	51254.	2	4950.0	31261.
ZONE 8 48-60"	32	7900.0	49892.	32	9953.1	62858.	2	8150.0	51471.

TABLE F8 (continued). NITRATE-N REMAINING IN SOIL PROFILE, WATERSHED P2, 1975

	4			5			6		
DATE	06-23-75			07-08-75			07-21-75		
DAYS AFTER PLANTING	33			48			61		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	31	6193.5	9779.	2	1000.0	1579.	32	12884.4	20343.
ZONE 2 3- 6"	31	3335.5	5266.	2	8050.0	12710.	32	10278.1	16228.
ZONE 3 6-12"	31	5448.4	17204.	2	4650.0	14683.	32	3581.2	11309.
ZONE 4 12-18"	31	5667.7	17897.	2	1000.0	3158.	32	3228.1	10193.
ZONE 5 18-24"	31	3941.9	12447.	2	2650.0	8368.	32	3556.2	11230.
ZONE 6 24-36"	31	4922.6	31088.	2	2100.0	13262.	32	4359.4	27531.
ZONE 7 36-48"	31	7564.5	47773.	2	10800.0	68207.	32	6575.0	41524.
ZONE 8 48-60"	31	9735.5	61484.	2	11900.0	75153.	32	10718.7	67693.

TABLE F8 (continued). NITRATE-N REMAINING IN SOIL PROFILE, WATERSHED P2, 1975

DATE	7			8			9		
	08-13-75			09-05-75			10-30-75		
DAYS AFTER PLANTING	84			107			162		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	2	1500.0	2368.	2	59650.0	94179.	32	2887.5	4559.
ZONE 2 3- 6"	2	1000.0	1579.	2	60250.0	95126.	32	2578.1	4070.
ZONE 3 6-12"	2	2700.0	8526.	2	50050.0	158043.	32	3768.7	11901.
ZONE 4 12-18"	2	5550.0	17525.	2	12800.0	40419.	32	5856.2	18492.
ZONE 5 18-24"	2	5800.0	18315.	2	23500.0	74206.	32	5409.4	17081.
ZONE 6 24-36"	2	1000.0	6315.	2	23850.0	150623.	32	7159.4	45214.
ZONE 7 36-48"	2	2250.0	14210.	2	41600.0	262721.	32	9334.4	58950.
ZONE 8 48-60"	2	5600.0	35366.	2	115000.0	726273.	32	9337.5	58970.

TABLE F9. CHLORIDE REMAINING IN SOIL PROFILE, WATERSHED P4, 1975

	1			2			3		
DATE	04-22-75			06-10-75			06-16-75		
DAYS AFTER PLANTING	-22			27			33		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	21	17757.1	29788.	21	34366.7	57651.	2	18850.0	31621.
ZONE 2 3- 6"	21	18623.8	31242.	21	25033.3	41994.	2	24750.0	41519.
ZONE 3 6-12"	21	15723.8	52754.	21	20085.7	67389.	2	30200.0	101323.
ZONE 4 12-18"	21	14757.1	49511.	21	15995.2	53665.	2	21750.0	72973.
ZONE 5 18-24"	21	22476.2	75409.	21	18095.2	60711.	2	15450.0	51836.
ZONE 6 24-36"	21	24095.2	161682.	21	22923.8	153822.	2	18900.0	126822.
ZONE 7 36-48"	21	32057.1	215108.	21	24128.6	161906.	2	16200.0	108704.
ZONE 8 48-60"	21	28428.6	190760.	21	29690.5	199227.	2	28950.0	194258.

TABLE F9 (continued). CHLORIDE REMAINING IN SOIL PROFILE, WATERSHED P4, 1975

DATE	4			5			6		
	06-23-75			07-08-75			07-21-75		
DAYS AFTER PLANTING	40			55			68		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	21	21795.2	36562.	2	24750.0	41519.	21	22171.4	37193.
ZONE 2 3- 6"	21	19128.6	32089.	2	27150.0	45545.	21	22223.8	37281.
ZONE 3 6-12"	21	20895.2	70105.	2	24250.0	81360.	21	21223.8	71207.
ZONE 4 12-18"	21	16742.9	56173.	2	19000.0	63746.	21	26504.8	88925.
ZONE 5 18-24"	21	18238.1	61190.	2	15300.0	51333.	21	18452.4	61909.
ZONE 6 24-36"	21	21438.1	143852.	2	17000.0	114072.	21	21957.1	147335.
ZONE 7 36-48"	21	29509.5	198013.	2	17300.0	116085.	21	29914.3	200729.
ZONE 8 48-60"	21	28352.4	190248.	2	24200.0	162385.	21	27738.1	186126.

TABLE F9 (continued). CHLORIDE REMAINING IN SOIL PROFILE, WATERSHED P4, 1975

	7			8			9		
DATE	08-13-75			09-05-75			10-30-75		
DAYS AFTER PLANTING	91			114			169		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	2	16950.0	28434.	2	11400.0	19124.	21	15576.2	26130.
ZONE 2 3- 6"	2	24600.0	41267.	2	13350.0	22395.	21	15071.4	25283.
ZONE 3 6-12"	2	19350.0	64921.	2	18500.0	62069.	21	13414.3	45006.
ZONE 4 12-18"	2	11550.0	38751.	2	24750.0	83038.	21	16742.9	56173.
ZONE 5 18-24"	2	10050.0	33718.	2	15250.0	51165.	21	18614.3	62452.
ZONE 6 24-36"	2	15650.0	105014.	2	16000.0	107362.	21	18314.3	122891.
ZONE 7 36-48"	2	21800.0	146281.	2	17000.0	114072.	21	27347.6	183506.
ZONE 8 48-60"	2	19850.0	133196.	2	28400.0	190568.	21	27371.4	183666.

TABLE F10. NITRATE-N REMAINING IN SOIL PROFILE, WATERSHED P4, 1975

	1			2			3		
DATE	04-22-75			06-10-75			06-16-75		
DAYS AFTER PLANTING	-22			27			33		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	21	1847.6	3099.	21	8861.9	14866.	2	5050.0	8472.
ZONE 2 3- 6"	21	1581.0	2652.	21	6271.4	10521.	2	8250.0	13840.
ZONE 3 6-12"	21	1652.4	5544.	21	5176.2	17366.	2	10550.0	35396.
ZONE 4 12-18"	21	1961.9	6582.	21	3033.3	10177.	2	7550.0	25331.
ZONE 5 18-24"	21	1866.7	6263.	21	2438.1	8180.	2	4350.0	14595.
ZONE 6 24-36"	21	3871.4	25978.	21	5523.8	37065.	2	3250.0	21808.
ZONE 7 36-48"	21	6919.0	46428.	21	10904.8	73172.	2	6450.0	43280.
ZONE 8 48-60"	21	8085.7	54256.	21	9485.7	63650.	2	7700.0	51668.

TABLE F10 (continued). NITRATE-N REMAINING IN SOIL PROFILE, WATERSHED P4, 1975

	4			5			6		
DATE	06-23-75			07-08-75			07-21-75		
DAYS AFTER PLANTING	40			55			68		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	21	2823.8	4737.	2	21250.0	35648.	21	18314.3	30723.
ZONE 2 3- 6"	21	3609.5	6055.	2	2000.0	3355.	21	5666.7	9506.
ZONE 3 6-12"	21	7190.5	24125.	2	9600.0	32209.	21	2671.4	8963.
ZONE 4 12-18"	21	3895.2	13069.	2	2700.0	9059.	21	2676.2	8979.
ZONE 5 18-24"	21	3338.1	11200.	2	3850.0	12917.	21	2323.8	7797.
ZONE 6 24-36"	21	3485.7	23390.	2	4450.0	29860.	21	4823.8	32368.
ZONE 7 36-48"	21	8523.8	57196.	2	6500.0	43616.	21	8647.6	58027.
ZONE 8 48-60"	21	9138.1	61318.	2	6550.0	43951.	21	9176.2	61573.

TABLE F10 (continued). NITRATE-N REMAINING IN SOIL PROFILE, WATERSHED P4, 1975

	7			8			9		
DATE	08-13-75			09-05-75			10-30-75		
DAYS AFTER PLANTING	91			114			169		
	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS	NO. OF SAMPLES	AVE. CONC. (PPB)	AMOUNT IN GRAMS
ZONE 1 0- 3"	2	3650.0	6123.	2	62700.0	105181.	21	2571.4	4314.
ZONE 2 3- 6"	2	2050.0	3439.	2	32150.0	53933.	21	2333.3	3914.
ZONE 3 6-12"	2	1050.0	3523.	2	11300.0	37912.	21	3476.2	11663.
ZONE 4 12-18"	2	1050.0	3523.	2	16750.0	56197.	21	4728.6	15865.
ZONE 5 18-24"	2	1100.0	3691.	2	11600.0	38919.	21	4457.1	14954.
ZONE 6 24-36"	2	1650.0	11072.	2	12300.0	82535.	21	4076.2	27352.
ZONE 7 36-48"	2	6150.0	41267.	2	67100.0	450250.	21	9109.5	61126.
ZONE 8 48-60"	2	9600.0	64417.	2	108600.0	728720.	21	9514.3	63842.

TABLE G1. DIPHENAMID CONCENTRATION (μg/kg) REMAINING IN SOIL PROFILE, WATERSHED P1, 1973

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	06-12-73	06-13-73	06-16-73	07-09-73	08-01-73	09-12-73
	-1	0	3	26	49	91
0.0 - 1.0	24.6	29363.3	5906.1	404.6	375.6	40.3
1.0 - 2.5	35.1	1443.5	1898.5	69.1	289.5	40.4
2.5 - 5.0	49.2	1306.6	638.1	40.0	60.9	23.3
5.0 - 7.5	34.9	505.2	156.2	29.2	10.1	23.4
7.5 -15.0	10.9	120.7	39.6	17.0	1.3	3.6
15.0 -22.5	5.4				1.0	0.4
22.5 -30.0					6.8	0.4

TABLE G2. PARAQUAT CONCENTRATION (μg/kg) REMAINING IN SOIL PROFILE, WATERSHED P1, 1973

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	06-12-73	06-13-73	06-16-73	07-09-73	08-01-73	09-12-73
	-1	0	3	26	49	91
0.0 - 1.0	4457.2	14618.7	11411.8	11107.8	8852.3	8231.3
1.0 - 2.5	5235.9	6585.0	8043.6	7387.9	6952.6	6038.0
2.5 - 5.0						
5.0 - 7.5						
7.5 -15.0						
15.0 -22.5						
22.5 -30.0						

TABLE G3. TRIFLURALIN CONCENTRATION (µg/kg) REMAINING IN SOIL PROFILE, WATERSHED P1, 1973

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	06-12-73	06-13-73	06-16-73	07-09-73	08-01-73	09-12-73
	-1	0	3	26	49	91
0.0 - 1.0	29.4	1211.8	557.7	462.8	136.9	90.5
1.0 - 2.5	26.0	546.2	509.8	435.8	208.8	66.3
2.5 - 5.0	28.9	163.7	417.6	365.1	195.7	80.7
5.0 - 7.5	19.8	22.7	45.4	78.8	129.4	37.5
7.5 -15.0	2.2	4.8	4.7	10.2	26.1	8.5
15.0 -22.5	2.3				3.1	2.3
22.5 -30.0	0.1				9.2	2.2

TABLE G4. ATRAZINE CONCENTRATION (μg/kg) REMAINING IN SOIL PROFILE, WATERSHED P2, 1973

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	05-05-73	05-11-73	05-14-73	05-23-73	05-24-73	05-30-73	06-07-73	0
	-6	0	3	12	13	19	27	
0.0 - 1.0	0.0	34737.5	14329.0	3380.0	1006.4	985.1	934.0	
1.0 - 2.5	0.0			1701.7	1135.7	1311.1	845.2	
2.5 - 5.0	0.0			878.1	1022.8	1018.6	595.8	
5.0 - 7.5	0.0			300.9	348.4	296.5	225.8	
7.5 -15.0	0.0			33.8	99.5	56.4	37.4	
15.0 -22.5	0.0							
22.5 -30.0	0.0							

TABLE G5. PARAQUAT CONCENTRATION (μg/kg) REMAINING IN SOIL PROFILE, WATERSHED P2, 1973

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	05-05-73	05-11-73	05-14-73	05-23-73	05-24-73	05-30-73	06-07-73	07-11-73
	-6	0	3	12	13	19	27	61
0.0 - 1.0	0.0	14408.0	12980.2	9199.1	6039.6	2679.5	2862.7	2807.8
1.0 - 2.5	0.0			1870.3	3010.3	1994.0	1190.9	1450.1
2.5 - 5.0	0.0			82.2	240.3	300.6	402.5	13.1
5.0 - 7.5	0.0			0.0	0.0	25.3	12.7	0.0
7.5 -15.0	0.0			0.0	0.0	1.3	0.6	0.0
15.0 -22.5	0.0							
22.5 -30.0	0.0							

TABLE G6. DIPHENAMID CONCENTRATION (μg/kg) REMAINING IN SOIL PROFILE, WATERSHED P3, 1973

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	06-12-73	06-15-73	06-29-73	07-10-73	07-18-73	09-10-73
	-3	0	14	25	33	87
0.0 - 1.0	11.7	24681.7	3442.3	1315.1	622.0	50.0
1.0 - 2.5	9.0	1553.7	577.6	413.6	645.7	39.5
2.5 - 5.0	6.0	670.3	120.2	106.8	87.3	24.1
5.0 - 7.5	10.0	865.8	44.1	58.2	33.5	5.0
7.5 -15.0	0.4	57.3	25.0	40.4	21.1	6.2
15.0 -22.5						0.0
22.5 -30.0						0.0

TABLE G7. PARAQUAT CONCENTRATION (μg/kg) REMAINING IN SOIL PROFILE, WATERSHED P3, 1973

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	06-12-73	06-15-73	06-29-73	07-10-73	07-18-73	09-10-73
	-3	0	14	25	33	87
0.0 - 1.0	8191.2	18181.1	14773.7	11516.0	13761.0	10890.1
1.0 - 2.5	7009.8	8606.5	7164.8	11817.8	7993.8	9278.0
2.5 - 5.0	7306.4				6766.3	
5.0 - 7.5	5101.1					
7.5 -15.0	692.2					
15.0 -22.5	10.1					
22.5 -30.0	0.0					

TABLE G8. TRIFLURALIN CONCENTRATION (µg/kg) REMAINING IN SOIL PROFILE, WATERSHED P3, 1973

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	06-12-73	06-15-73	06-29-73	07-10-73	07-18-73	09-10-73
	-3	0	14	25	33	87
0.0 - 1.0	29.2	1649.6	881.9	444.0	455.3	129.5
1.0 - 2.5	28.0	1048.7	779.9	449.6	421.3	165.1
2.5 - 5.0	28.4	242.9	342.6	293.4	393.4	131.6
5.0 - 7.5	21.9	40.3	38.4	55.1	129.4	53.5
7.5 -15.0	0.2	9.7	10.4	9.9	14.5	4.3
15.0 -22.5	4.6					5.4
22.5 -30.0	0.0					4.2

TABLE G9. ATRAZINE CONCENTRATION ($\mu g/kg$) REMAINING IN SOIL PROFILE, WATERSHED P4, 1973

DEPTH ZONES IN CENTIMETERS	SAMPLING DATE / DAYS AFTER PLANTING								
	05-05-73	05-11-73	05-14-73	05-23-73	05-24-73	05-30-73	06-08-73	06-12-73	07-10-73
	-6	0	3	12	13	19	28	32	60
0.0 - 1.0	0.0	41080.3	17855.9	1305.3	791.0	580.2	379.1	335.3	73.3
1.0 - 2.5	0.0			1081.3	1258.0	763.5	479.8	295.7	136.6
2.5 - 5.0	0.0			623.4	727.1	644.2	329.2	292.3	135.3
5.0 - 7.5	0.0			221.9	306.8	275.0	200.3	135.0	77.2
7.5 -15.0	0.0			60.3	89.5	86.0	51.4	108.8	39.8
15.0 -22.5	0.0								
22.5 -30.0	0.0								

TABLE G10. PARAQUAT CONCENTRATION (μg/kg) REMAINING IN SOIL PROFILE, WATERSHED P4, 1973

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	05-05-73	05-11-73	05-14-73	05-23-73	05-24-73	05-30-73	06-08-73	06-12-73	07-10-73
	-6	0	3	12	13	19	28	32	60
0.0 - 1.0	0.0	20987.8	16271.5	6876.9	6101.6	3778.7	4719.1	4524.9	3326.6
1.0 - 2.5	0.0			1194.0	984.7	2596.0	3246.9	2245.0	1667.9
2.5 - 5.0	0.0			301.8	73.3	249.0	558.9		50.6
5.0 - 7.5	0.0			52.3	0.0	0.0	31.2		0.0
7.5 -15.0	0.0			0.0	0.0	0.0	1.5		0.0
15.0 -22.5	0.0								
22.5 -30.0	0.0								

TABLE G11. DIPHENAMID CONCENTRATION (μg/kg) REMAINING IN SOIL PROFILE, WATERSHED P1, 1974

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	05-25-74	06-12-74	06-21-74	07-02-74	07-08-74	07-30-74
	-5	13	22	33	39	61
0.0 - 1.0	15.8	1860.2	830.3	187.8	89.2	39.5
1.0 - 2.5	14.7	319.0	157.3	607.1	78.5	4.0
2.5 - 5.0	13.0	126.7	48.6	372.6	37.3	14.7
5.0 - 7.5	2.4	71.7	5.5	6.1	4.3	11.9
7.5 -15.0	2.2	28.8	0.0	0.4	26.8	68.4
15.0 -22.5	2.1	4.7	0.0	0.4	102.1	112.4
22.5 -30.0	1.0	7.7	0.0	0.3	145.5	109.2

TABLE G12. PARAQUAT CONCENTRATION (μg/kg) REMAINING IN SOIL PROFILE, WATERSHED P1, 1974

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	05-25-74	06-12-74	06-21-74	07-02-74	07-08-74	07-30-74
	-5	13	22	33	39	61
0.0 - 1.0	5512.0	15048.4	12870.5	8455.5	8368.5	6270.8
1.0 - 2.5	6081.6	7744.6	6454.8	9496.5	9474.9	5596.3
2.5 - 5.0	5225.1	6320.5				
5.0 - 7.5	2746.5	4952.3				
7.5 -15.0	790.8					
15.0 -22.5	368.9					
22.5 -30.0	168.7					

TABLE G13. PARAQUAT CONCENTRATION (μg/kg) REMAINING IN SOIL PROFILE, WATERSHED P2, 1974

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	04-19-74	05-08-74	05-13-74	05-24-74	07-29-74
	-10	9	14	25	91
0.0 - 1.0	1270.8	8969.6	8473.0	9342.7	5139.4
1.0 - 2.5	1220.8	3118.1	2122.4	3207.9	2518.1
2.5 - 5.0	474.4	778.7			
5.0 - 7.5	183.8	386.3			
7.5 -15.0	0.0	80.1			
15.0 -22.5	0.0	0.0			
22.5 -30.0	68.4	0.0			

TABLE G14. ATRAZINE CONCENTRATION (μg/kg) REMAINING IN SOIL PROFILE, WATERSHED P2, 1974

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	04-19-74	05-08-74	05-13-74	05-24-74	07-29-74
	-10	9	14	25	91
0.0 - 1.0	19.2	4246.7	4640.7	1805.4	98.3
1.0 - 2.5	25.2	1576.7	1465.7	1141.9	140.4
2.5 - 5.0	24.7	752.7	350.7	522.4	83.4
5.0 - 7.5	15.3	203.7	137.4	159.1	44.8
7.5 -15.0	7.6	53.4	43.5	30.6	8.6
15.0 -22.5	5.4	24.4	18.9	15.5	1.9
22.5 -30.0	2.7	32.6	25.2	15.3	2.6

TABLE G15. DIPHENAMID CONCENTRATION (μg/kg) REMAINING IN SOIL PROFILE, WATERSHED P3, 1974

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	05-28-74	06-12-74	06-14-74	06-21-74	07-02-74	07-08-74	07-30-74
	-2	13	15	22	33	39	61
0.0 - 1.0	19.4	2460.3	849.6	1464.0	72.9	36.0	4.5
1.0 - 2.5	18.7	436.6	366.5	470.1	93.4	45.4	4.5
2.5 - 5.0	18.6	102.7	55.9		9.8	2.3	0.0
5.0 - 7.5	5.1		29.2		0.3	0.0	0.0
7.5 -15.0	0.0				22.0		0.0
15.0 -22.5	0.0				0.0		0.0
22.5 -30.0	0.0				0.4		0.0

TABLE G16. PARAQUAT CONCENTRATION (μg/kg) REMAINING IN SOIL PROFILE, WATERSHED P3, 1974

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	05-28-74	06-12-74	06-14-74	06-21-74	07-02-74	07-08-74	07-30-74
	-2	13	15	22	33	39	61
0.0 - 1.0	8679.5	18021.1	9762.4	12463.5	8931.7	4843.9	8117.9
1.0 - 2.5	8258.1	9702.5	7822.5	10358.5	9914.1	4678.6	7653.4
2.5 - 5.0	6665.4	10530.7	4427.6				
5.0 - 7.5	4165.9	9441.2	5051.5				
7.5 -15.0	828.3						
15.0 -22.5	249.4						
22.5 -30.0	159.0						

TABLE G17. ATRAZINE CONCENTRATION (µg/kg) REMAINING IN SOIL PROFILE, WATERSHED P4, 1974

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	04-22-74	05-06-74	05-13-74	05-24-74	07-01-74	07-29-74
	-7	7	14	25	63	91
0.0 - 1.0	19.1	5535.6	3181.0	920.5	203.0	79.8
1.0 - 2.5	21.1	2164.6	1256.8	619.2	202.8	81.6
2.5 - 5.0	17.9	391.5	319.1	331.2	152.8	50.2
5.0 - 7.5	14.7	86.6	82.8	149.6	77.9	15.1
7.5 -15.0	10.1	24.3	32.1	60.6	19.2	1.6
15.0 -22.5	7.8	15.8	17.6	27.6	12.1	1.6
22.5 -30.0	22.3	17.4	20.6	25.0	4.2	1.6

TABLE G18. PARAQUAT CONCENTRATION (μg/kg) REMAINING IN SOIL PROFILE, WATERSHED P4, 1974

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	04-22-74	05-06-74	05-13-74	05-24-74	07-01-74	07-29-74
	-7	7	14	25	63	91
0.0 - 1.0	895.7	9943.6	7808.4	8588.5	9321.4	6668.4
1.0 - 2.5	807.5	2761.7	2097.4	2173.1	5214.9	2964.7
2.5 - 5.0						
5.0 - 7.5						
7.5 -15.0						
15.0 -22.5						
22.5 -30.0						

TABLE G19. PARAQUAT CONCENTRATION (µg/kg) REMAINING IN SOIL PROFILE, WATERSHED P1, 1975

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	05-29-75
	-4
0.0 - 1.0	5418.0
1.0 - 2.5	7400.0
2.5 - 5.0	6040.3
5.0 - 7.5	5986.1
7.5 -15.0	2364.5
15.0 -22.5	746.3
22.5 -30.0	790.0

TABLE G20. PROPAZINE CONCENTRATION (μg/kg) REMAINING IN SOIL PROFILE, WATERSHED P1, 1975

DEPTH ZONES IN CENTIMETERS	SAMPLING DATE / DAYS AFTER PLANTING			
	05-29-75	06-16-75	07-21-75	08-05-75
	-4	14	49	64
0.0 - 1.0	0.0	2907.6	340.1	167.5
1.0 - 2.5	0.0	870.5		155.8
2.5 - 5.0	0.0	436.4		113.1
5.0 - 7.5	0.0	153.4		60.0
7.5 -15.0	0.0	45.0	21.2	18.9
15.0 -22.5	0.0	14.2		3.7
22.5 -30.0	0.0	0.0		1.6

TABLE G21. ATRAZINE CONCENTRATION (µg/kg) REMAINING IN SOIL PROFILE, WATERSHED P2, 1975

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	04-24-75	06-05-75	06-17-75	07-21-75
	-27	15	27	61
0.0 - 1.0	34.9	1304.9	304.1	
1.0 - 2.5	43.0	754.8	379.7	
2.5 - 5.0	33.6	307.2	202.4	
5.0 - 7.5	35.7	122.9	112.0	
7.5 -15.0	13.6	4.1	26.0	
15.0 -22.5	13.2	0.0	12.1	
22.5 -30.0	7.3	0.0	1.6	

TABLE G22. CYANAZINE CONCENTRATION (μg/kg) REMAINING IN SOIL PROFILE, WATERSHED P2, 1975

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	06-05-75	06-17-75	07-21-75
	15	27	61
0.0 - 1.0	1113.0	181.4	
1.0 - 2.5	529.4	98.1	
2.5 - 5.0	165.5	61.6	
5.0 - 7.5	38.4	3.3	
7.5 -15.0	57.7	3.8	
15.0 -22.5	58.0	6.8	
22.5 -30.0	38.1	4.9	

TABLE G23. PARAQUAT CONCENTRATION (μg/kg) REMAINING IN SOIL PROFILE, WATERSHED P2, 1975

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	04-24-75 -27
0.0 - 1.0	5293.9
1.0 - 2.5	2752.9
2.5 - 5.0	1356.0
5.0 - 7.5	585.5
7.5 -15.0	30.3
15.0 -22.5	15.8
22.5 -30.0	0.0

TABLE G24. 2,4-D CONCENTRATION (μg/kg) REMAINING IN SOIL PROFILE, WATERSHED P2, 1975

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	06-05-75	06-17-75	07-21-75
	15	27	61
0.0 - 1.0	650.3	5.1	
1.0 - 2.5	167.9	0.0	
2.5 - 5.0	0.0	0.0	
5.0 - 7.5		0.0	
7.5 -15.0		0.0	
15.0 -22.5		0.0	
22.5 -30.0		0.0	

TABLE G25. DIPHENAMID CONCENTRATION (µg/kg) REMAINING IN SOIL PROFILE, WATERSHED P3, 1975

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	05-06-75	06-16-75	07-22-75	08-04-75
	-22	19	55	68
0.0 - 1.0	0.0	254.1		0.0
1.0 - 2.5	0.0	21.7		0.0
2.5 - 5.0	0.0	0.0		0.0
5.0 - 7.5	0.0	0.0		0.0
7.5 -15.0	0.0	0.0		0.0
15.0 -22.5	0.0	0.0		0.0
22.5 -30.0	0.0	0.0		0.0

TABLE G26. PARAQUAT CONCENTRATION (μg/kg) REMAINING IN SOIL PROFILE, WATERSHED P3, 1975

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	05-06-75 -22
0.0 - 1.0	7780.3
1.0 - 2.5	8895.2
2.5 - 5.0	8959.5
5.0 - 7.5	
7.5 -15.0	3787.2
15.0 -22.5	192.3
22.5 -30.0	134.7

TABLE G27. ATRAZINE CONCENTRATION (μg/kg) REMAINING IN SOIL PROFILE, WATERSHED P4, 1975

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	04-24-75	06-03-75	06-18-75	07-22-75
	-20	20	35	69
0.0 - 1.0	57.2	416.7	243.9	42.3
1.0 - 2.5	64.1	555.3	244.2	54.5
2.5 - 5.0	23.3	260.3	168.5	54.4
5.0 - 7.5	31.0	85.2	72.5	40.0
7.5 -15.0	6.8	12.7	8.2	13.3
15.0 -22.5	6.4	29.6	7.2	5.6
22.5 -30.0	4.5	3.1	0.0	3.4

TABLE G28. CYANAZINE CONCENTRATION (μg/kg) REMAINING IN SOIL PROFILE, WATERSHED P4, 1975

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	06-03-75	06-18-75	07-22-75
	20	35	69
0.0 - 1.0	94.4	45.1	0.0
1.0 - 2.5	13.7	24.4	0.0
2.5 - 5.0	0.0	15.1	0.0
5.0 - 7.5	0.0	46.5	0.0
7.5 -15.0	0.0	61.7	0.0
15.0 -22.5	0.0	52.1	0.0
22.5 -30.0	1.8	39.4	0.0

TABLE G29. PARAQUAT CONCENTRATION (μg/kg) REMAINING IN SOIL PROFILE, WATERSHED P4, 1975

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	04-24-75 -20
0.0 - 1.0	3587.2
1.0 - 2.5	3276.3
2.5 - 5.0	1704.3
5.0 - 7.5	516.8
7.5 -15.0	41.0
15.0 -22.5	0.0
22.5 -30.0	61.7

TABLE G30. 2,4-D CONCENTRATION (μg/kg) REMAINING IN SOIL PROFILE, WATERSHED P4, 1975

SAMPLING DATE / DAYS AFTER PLANTING

DEPTH ZONES IN CENTIMETERS	06-03-75 20
0.0 - 1.0	0.0
1.0 - 2.5	
2.5 - 5.0	
5.0 - 7.5	
7.5 -15.0	
15.0 -22.5	
22.5 -30.0	

TABLE H1. CHLORIDE RUNOFF SUMMARY, WATERSHED P2, 1974

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. NUTRIENT IN SED. (PPM)	TOTAL NUTRIENT IN SED. (GRAMS)	MN. CONC. NUTRIENT IN WATER (PPM)	TOTAL NUTRIENT IN WATER (GRAMS)	TOTAL AMOUNT OF NUTRIENT (GRAMS)	% OF SEASON TOTAL LOSS
1	04-04-74	-25	3.30	426926.	35517.	12.5	8.32	--------	--------	0.0	0.1	0.1	
2	04-13-74	-16	2.29	295564.	45350.	18.8	15.3	--------	--------	0.0	0.1	0.1	
3	05-05-74	6	1.88	243071.	2053.	13.1	0.84	--------	--------	2.2	4.5	4.5	0.07
4	05-23-74	24	7.01	906346.	94942.	119.6	10.5	--------	--------	4.3	406.6	406.6	6.18
5	06-20-74	52	1.22	157608.	1844.	1.8	1.17	--------	--------	9.5	17.5	17.5	0.27
6	06-27-74	59	5.39	696244.	152923.	294.4	22.0	--------	--------	2.3	357.1	357.1	5.42
7	06-27-74	59	5.44	702838.	386371.	962.2	55.0	--------	--------	2.5	947.5	947.5	14.4
8	07-24-74	86	1.47	190449.	19149.	30.4	10.1	--------	--------				
9	07-27-74	89	7.21	932721.	587874.	859.6	63.0	--------	--------	4.3	2550.8	2550.8	38.7
10	08-10-74	103	2.85	367839.	28215.	29.3	7.67	--------	--------	2.8	78.1	78.1	1.19
11	08-16-74	109	5.00	646984.	106941.	91.9	16.5	--------	--------	3.2	344.2	344.2	5.23
12	08-17-74	110	1.52	197043.	16840.	9.5	8.55	--------	--------	2.2	36.6	36.6	0.56
13	08-29-74	122	1.52	197043.	6437.	4.9	3.27	--------	--------	10.2	65.7	65.7	1.00
14	09-01-74	125	1.14	147782.	7702.	0.7	5.21	--------	--------	6.4	49.3	49.3	0.75
15	12-15-74	230	3.10	400680.	661.	0.0	0.17	--------	--------	5.6	3.7	3.7	0.06
16	12-19-74	234	2.16	279144.	321.	0.0	0.11	--------	--------	6.2	2.0	2.0	0.03
17	12-29-74	244	2.29	295564.	909.	0.0	0.31	--------	--------	3.6	3.3	3.3	0.05
18	01-10-75	256	2.64	341593.	6110.	4.0	1.79	--------	--------	3.6	22.0	22.0	0.33
19	01-12-75	258	2.29	295564.	7110.	0.2	2.41	--------	--------	2.8	19.6	19.6	0.30
20	01-24-75	270	2.67	344825.	6383.	0.2	1.85	--------	--------	1.6	10.1	10.1	0.15
21	02-04-75	281	3.56	459767.	20459.	2.8	4.45	--------	--------	0.7	14.0	14.0	0.21
22	02-24-75	301	2.79	361245.	7801.	4.9	2.16	--------	--------	1.9	14.9	14.9	0.23
23	03-13-75	318	9.45	1221691.	597288.	75.6	48.9	--------	--------	1.7	1027.2	1027.2	15.6
24	03-16-75	321	1.78	229883.	6060.	1.1	2.64	--------	--------	4.0	24.1	24.1	0.37
25	03-18-75	323	2.13	275912.	18972.	0.4	6.88	--------	--------	3.3	62.8	62.8	0.95
26	04-02-75	338	6.48	837432.	213506.	29.0	25.5	--------	--------	2.7	566.0	566.0	8.60
27	05-07-75	373	4.32	558288.	36425.	144.5	6.52	--------	--------	3.1	114.3	114.3	1.74
28	05-14-75	380	1.78	229883.	16924.	54.0	7.36	--------	--------	1.1	18.6	18.6	0.28
29	05-16-75	382	1.73	223290.	10125.	35.8	4.53	--------	--------	2.4	23.9	23.9	0.36
	TOTAL		96.39	12463222.	2441211.	2801.2	----	--------	--------	-------	6583.2	6784.4	----

TABLE H2. NH_4+N RUNOFF SUMMARY, WATERSHED P2, 1974

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. NUTRIENT IN SED. (PPM)	TOTAL NUTRIENT IN SED. (GRAMS)	MN. CONC. NUTRIENT IN WATER (PPM)	TOTAL NUTRIENT IN WATER (GRAMS)	TOTAL AMOUNT OF NUTRIENT (GRAMS)	% OF SEASON TOTAL LOSS
1	04-04-74	-25	3.30	426926.	35517.	12.5	8.32						
2	04-13-74	-16	2.29	295564.	45350.	18.8	15.3						
3	05-05-74	6	1.88	243071.	2053.	13.1	0.84	0.0	0.0	1.7	3.5	3.5	0.12
4	05-23-74	24	7.01	906346.	94942.	119.6	10.5	457.3	54.7	0.2	20.2	74.9	2.46
5	06-20-74	52	1.22	157608.	1844.	1.8	1.17			4.1	7.6	7.6	0.25
6	06-27-74	59	5.39	696244.	152923.	294.4	22.0			2.5	388.7	388.7	12.8
7	06-27-74	59	5.44	702838.	386371.	962.2	55.0	289.6	278.7	2.0	775.9	1054.6	34.7
8	07-24-74	86	1.47	190449.	19149.	30.4	10.1	1187.0	36.1	1.9	36.4	72.5	2.39
9	07-27-74	89	7.21	932721.	587874.	859.6	63.0	298.4	256.5	0.5	268.0	524.5	17.3
10	08-10-74	103	2.85	367839.	28215.	29.3	7.67	739.7	21.7	0.2	6.2	27.9	0.92
11	08-16-74	109	5.00	646984.	106941.	91.9	16.5	577.1	53.0	3.2	346.2	399.2	13.1
12	08-17-74	110	1.52	197043.	16840.	9.5	8.55	846.4	8.0	0.0	0.0	8.0	0.26
13	08-29-74	122	1.52	197043.	6437.	4.9	3.27	1500.0	7.3	0.1	0.6	7.9	0.26
14	09-01-74	125	1.14	147782.	7702.	0.7	5.21	9000.0	6.2	0.0	0.0	6.2	0.20
15	12-15-74	230	3.10	400680.	661.	0.0	0.17			0.0	0.0	0.0	0.0
16	12-19-74	234	2.16	279144.	321.	0.0	0.11			0.0	0.0	0.0	0.0
17	12-29-74	244	2.29	295564.	909.	0.0	0.31			0.3	0.3	0.3	<.01
18	01-10-75	256	2.64	341593.	6110.	4.0	1.79	154.0	0.6	0.9	5.5	6.1	0.20
19	01-12-75	258	2.29	295564.	7110.	0.2	2.41	8186.6	1.8	0.1	0.4	2.2	0.07
20	01-24-75	270	2.67	344825.	6383.	0.2	1.85	4018.6	0.8	0.1	0.6	1.4	0.05
21	02-04-75	281	3.56	459767.	20459.	2.8	4.45	1681.5	4.7	0.2	4.9	9.6	0.32
22	02-24-75	301	2.79	361245.	7801.	4.9	2.16	177.8	0.9	0.1	0.4	1.3	0.04
23	03-13-75	318	9.45	1221691.	597288.	75.6	48.9	3982.5	301.1	0.0	28.3	329.4	10.8
24	03-16-75	321	1.78	229883.	6060.	1.1	2.64	1100.3	1.3	0.4	2.4	3.7	0.12
25	03-18-75	323	2.13	275912.	18972.	0.4	6.88	2576.0	0.9	0.1	1.9	2.8	0.09
26	04-02-75	338	6.48	837432.	213506.	29.0	25.5	2517.8	73.0	0.0	0.0	73.0	2.40
27	05-07-75	373	4.32	558288.	36425.	144.5	6.52	7.4	1.1	0.5	19.1	20.2	0.66
28	05-14-75	380	1.78	229883.	16924.	54.0	7.36	41.0	2.2	0.4	6.8	9.0	0.30
29	05-16-75	382	1.73	223290.	10125.	35.8	4.53	29.7	1.1	0.3	3.0	4.1	0.13
TOTAL			96.39	12463222.	2441211.	2801.2	----	--------	1111.7	-------	1926.9	3038.6	----

TABLE H3. NO_3-N RUNOFF SUMMARY, WATERSHED P2, 1974

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. NUTRIENT IN SED. (PPM)	TOTAL NUTRIENT IN SED. (GRAMS)	MN. CONC. NUTRIENT IN WATER (PPM)	TOTAL NUTRIENT IN WATER (GRAMS)	TOTAL AMOUNT OF NUTRIENT (GRAMS)	% OF SEASON TOTAL LOSS
1	04-04-74	-25	3.30	426926.	35517.	12.5	8.32	--------	--------	0.1	4.0	4.0	
2	04-13-74	-16	2.29	295564.	45350.	18.8	15.3	--------	--------	0.2	8.5	8.5	
3	05-05-74	6	1.88	243071.	2053.	13.1	0.84	--------	--------	1.1	2.3	2.3	0.21
4	05-23-74	24	7.01	906346.	94942.	119.6	10.5	--------	--------	0.8	72.1	72.1	6.45
5	06-20-74	52	1.22	157608.	1844.	1.8	1.17	--------	--------	11.4	21.0	21.0	1.88
6	06-27-74	59	5.39	696244.	152923.	294.4	22.0	--------	--------	1.2	186.2	186.2	16.7
7	06-27-74	59	5.44	702838.	386371.	962.2	55.0	--------	--------	1.1	426.8	426.8	38.2
8	07-24-74	86	1.47	190449.	19149.	30.4	10.1	--------	--------				
9	07-27-74	89	7.21	932721.	587874.	859.6	63.0	--------	--------	0.2	131.0	131.0	11.7
10	08-10-74	103	2.85	367839.	28215.	29.3	7.67	--------	--------	0.8	22.9	22.9	2.05
11	08-16-74	109	5.00	646984.	106941.	91.9	16.5	--------	--------	0.6	69.4	69.4	6.21
12	08-17-74	110	1.52	197043.	16840.	9.5	8.55	--------	--------	0.5	8.4	8.4	0.75
13	08-29-74	122	1.52	197043.	6437.	4.9	3.27	--------	--------	1.0	6.4	6.4	0.57
14	09-01-74	125	1.14	147782.	7702.	0.7	5.21	--------	--------	1.5	11.6	11.6	1.04
15	12-15-74	230	3.10	400680.	661.	0.0	0.17	--------	--------	1.6	1.1	1.1	0.10
16	12-19-74	234	2.16	279144.	321.	0.0	0.11	--------	--------	0.7	0.2	0.2	0.02
17	12-29-74	244	2.29	295564.	909.	0.0	0.31	--------	--------	0.4	0.4	0.4	0.04
18	01-10-75	256	2.64	341593.	6110.	4.0	1.79	--------	--------	0.4	2.4	2.4	0.21
19	01-12-75	258	2.29	295564.	7110.	0.2	2.41	--------	--------	0.1	0.7	0.7	0.06
20	01-24-75	270	2.67	344825.	6383.	0.2	1.85	--------	--------	0.1	0.8	0.8	0.07
21	02-04-75	281	3.56	459767.	20459.	2.8	4.45	--------	--------	0.2	3.3	3.3	0.30
22	02-24-75	301	2.79	361245.	7801.	4.9	2.16	--------	--------	0.1	0.8	0.8	0.07
23	03-13-75	318	9.45	1221691.	597288.	75.6	48.9	--------	--------	0.1	61.5	61.5	5.50
24	03-16-75	321	1.78	229883.	6060.	1.1	2.64	--------	--------	0.5	3.1	3.1	0.28
25	03-18-75	323	2.13	275912.	18972.	0.4	6.88	--------	--------	0.6	11.4	11.4	1.02
26	04-02-75	338	6.48	837432.	213506.	29.0	25.5	--------	--------	0.1	21.4	21.4	1.92
27	05-07-75	373	4.32	558288.	36425.	144.5	6.52	--------	--------	0.6	21.9	21.9	1.96
28	05-14-75	380	1.78	229883.	16924.	54.0	7.36	--------	--------	1.0	16.9	16.9	1.51
29	05-16-75	382	1.73	223290.	10125.	35.8	4.53	--------	--------	1.3	13.2	13.2	1.18
TOTAL			96.39	12463222.	2441211.	2801.2	----	--------	--------	-------	1117.2	1117.2	----

TABLE H4. PO_4-P RUNOFF SUMMARY, WATERSHED P2, 1974

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. NUTRIENT IN SED. (PPM)	TOTAL NUTRIENT IN SED. (GRAMS)	MN. CONC. NUTRIENT IN WATER (PPM)	TOTAL NUTRIENT IN WATER (GRAMS)	TOTAL AMOUNT OF NUTRIENT (GRAMS)	% OF SEASON TOTAL LOSS
1	04-04-74	-25	3.30	426926.	35517.	12.5	8.32	--------	--------				
2	04-13-74	-16	2.29	295564.	45350.	18.8	15.3	--------	--------				
3	05-05-74	6	1.88	243071.	2053.	13.1	0.84	--------	--------	0.1	0.2	0.2	0.06
4	05-23-74	24	7.01	906346.	94942.	119.6	10.5	--------	--------	0.0	2.8	2.8	0.86
5	06-20-74	52	1.22	157608.	1844.	1.8	1.17	--------	--------	0.5	0.9	0.9	0.28
6	06-27-74	59	5.39	696244.	152923.	294.4	22.0	--------	--------	0.4	55.1	55.1	17.0
7	06-27-74	59	5.44	702838.	386371.	962.2	55.0	--------	--------	0.1	36.6	36.6	11.3
8	07-24-74	86	1.47	190449.	19149.	30.4	10.1	--------	--------	0.1	2.0	2.0	0.62
9	07-27-74	89	7.21	932721.	587874.	859.6	63.0	--------	--------	0.1	33.3	33.3	10.3
10	08-10-74	103	2.85	367839.	28215.	29.3	7.67	--------	--------	0.1	2.2	2.2	0.68
11	08-16-74	109	5.00	646984.	106941.	91.9	16.5	--------	--------	0.1	7.4	7.4	2.28
12	08-17-74	110	1.52	197043.	16840.	9.5	8.55	--------	--------	0.1	1.7	1.7	0.52
13	08-29-74	122	1.52	197043.	6437.	4.9	3.27	--------	--------	0.3	1.7	1.7	0.52
14	09-01-74	125	1.14	147782.	7702.	0.7	5.21	--------	--------	0.2	1.3	1.3	0.40
15	12-15-74	230	3.10	400680.	661.	0.0	0.17	--------	--------	0.2	0.1	0.1	0.03
16	12-19-74	234	2.16	279144.	321.	0.0	0.11	--------	--------	0.1	0.0	0.0	0.0
17	12-29-74	244	2.29	295564.	909.	0.0	0.31	--------	--------	0.3	0.3	0.3	0.09
18	01-10-75	256	2.64	341593.	6110.	4.0	1.79	--------	--------	0.3	1.8	1.8	0.55
19	01-12-75	258	2.29	295564.	7110.	0.2	2.41	--------	--------	0.3	2.0	2.0	0.62
20	01-24-75	270	2.67	344825.	6383.	0.2	1.85	--------	--------	0.1	0.8	0.8	0.25
21	02-04-75	281	3.56	459767.	20459.	2.8	4.45	--------	--------	0.2	5.1	5.1	1.57
22	02-24-75	301	2.79	361245.	7801.	4.9	2.16	--------	--------	0.2	1.3	1.3	0.40
23	03-13-75	318	9.45	1221691.	597288.	75.6	48.9	--------	--------	0.2	112.9	112.9	34.8
24	03-16-75	321	1.78	229883.	6060.	1.1	2.64	--------	--------	0.4	2.3	2.3	0.71
25	03-18-75	323	2.13	275912.	18972.	0.4	6.88	--------	--------	0.1	2.2	2.2	0.68
26	04-02-75	338	6.48	837432.	213506.	29.0	25.5	--------	--------	0.2	44.6	44.6	13.7
27	05-07-75	373	4.32	558288.	36425.	144.5	6.52	--------	--------	0.1	4.1	4.1	1.26
28	05-14-75	380	1.78	229883.	16924.	54.0	7.36	--------	--------	0.1	1.2	1.2	0.37
29	05-16-75	382	1.73	223290.	10125.	35.8	4.53	--------	--------	0.1	0.6	0.6	0.18
TOTAL			96.39	12463222.	2441211.	2801.2	----	--------	--------	-------	324.5	324.5	----

TABLE H5. TKN RUNOFF SUMMARY, WATERSHED P2, 1974

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. NUTRIENT IN SED. (PPM)	TOTAL NUTRIENT IN SED. (GRAMS)	MN. CONC. NUTRIENT IN WATER (PPM)	TOTAL NUTRIENT IN WATER (GRAMS)	TOTAL AMOUNT OF NUTRIENT (GRAMS)	% OF SEASON TOTAL LOSS
1	04-04-74	-25	3.30	426926.	35517.	12.5	8.32						
2	04-13-74	-16	2.29	295564.	45350.	18.8	15.3						
3	05-05-74	6	1.88	243071.	2053.	13.1	0.84	893.0	11.7	4.3	8.8	20.5	0.14
4	05-23-74	24	7.01	906346.	94942.	119.6	10.5	790.5	94.6	2.2	205.5	300.1	2.00
5	06-20-74	52	1.22	157608.	1844.	1.8	1.17			25.9	47.8	47.8	0.32
6	06-27-74	59	5.39	696244.	152923.	294.4	22.0			3.8	580.2	580.2	3.86
7	06-27-74	59	5.44	702838.	386371.	962.2	55.0	2402.9	2311.9	3.1	1204.4	3516.3	23.4
8	07-24-74	86	1.47	190449.	19149.	30.4	10.1	3437.0	104.6	5.8	111.1	215.7	1.43
9	07-27-74	89	7.21	932721.	587874.	859.6	63.0	3109.7	2673.2	2.0	1185.3	3858.5	25.7
10	08-10-74	103	2.85	367839.	28215.	29.3	7.67	2948.0	86.5	1.9	54.8	141.3	0.94
11	08-16-74	109	5.00	646984.	106941.	91.9	16.5	2198.2	201.9	1.4	145.9	347.8	2.31
12	08-17-74	110	1.52	197043.	16840.	9.5	8.55	3338.7	31.6	1.4	23.6	55.2	0.37
13	08-29-74	122	1.52	197043.	6437.	4.9	3.27	3375.0	16.5	2.4	15.4	31.9	0.21
14	09-01-74	125	1.14	147782.	7702.	0.7	5.21	23000.0	15.9	0.2	1.6	17.5	0.12
15	12-15-74	230	3.10	400680.	661.	0.0	0.17			3.2	2.1	2.1	0.01
16	12-19-74	234	2.16	279144.	321.	0.0	0.11			2.7	0.9	0.9	<.01
17	12-29-74	244	2.29	295564.	909.	0.0	0.31			3.0	2.7	2.7	0.02
18	01-10-75	256	2.64	341593.	6110.	4.0	1.79	4754.0	18.9	1.4	8.5	27.4	0.18
19	01-12-75	258	2.29	295564.	7110.	0.2	2.41	22562.2	4.8	3.2	22.6	27.4	0.18
20	01-24-75	270	2.67	344825.	6383.	0.2	1.85	21256.8	4.1	344.6	2199.5	2203.6	14.7
21	02-04-75	281	3.56	459767.	20459.	2.8	4.45	6414.4	18.0	0.7	14.7	32.7	0.22
22	02-24-75	301	2.79	361245.	7801.	4.9	2.16	6588.8	32.5	1.4	11.2	43.7	0.29
23	03-13-75	318	9.45	1221691.	597288.	75.6	48.9	15469.9	1169.6	1.9	1126.3	2295.9	15.3
24	03-16-75	321	1.78	229883.	6060.	1.1	2.64	6700.8	7.7	2.8	16.8	24.5	0.16
25	03-18-75	323	2.13	275912.	18972.	0.4	6.88	11167.7	4.1	1.2	22.2	26.3	0.17
26	04-02-75	338	6.48	837432.	213506.	29.0	25.5	18433.7	534.4	2.5	540.8	1075.2	7.15
27	05-07-75	373	4.32	558288.	36425.	144.5	6.52	83.7	12.1	1.7	61.6	73.7	0.49
28	05-14-75	380	1.78	229883.	16924.	54.0	7.36			2.5	42.0	42.0	0.28
29	05-16-75	382	1.73	223290.	10125.	35.8	4.53	111.3	4.0	1.9	19.1	23.1	0.15
TOTAL			96.39	12463222.	2441211.	2801.2	----	--------	7358.6	-------	7675.4	15034.0	----

TABLE H6. TOTAL-P RUNOFF SUMMARY, WATERSHED P2, 1974

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. NUTRIENT IN SED. (PPM)	TOTAL NUTRIENT IN SED. (GRAMS)	MN. CONC. NUTRIENT IN WATER (PPM)	TOTAL NUTRIENT IN WATER (GRAMS)	TOTAL AMOUNT OF NUTRIENT (GRAMS)	% OF SEASON TOTAL LOSS
1	04-04-74	-25	3.30	426926.	35517.	12.5	8.32						
2	04-13-74	-16	2.29	295564.	45350.	18.8	15.3						
3	05-05-74	6	1.88	243071.	2053.	13.1	0.84	603.0	7.9	0.1	0.3	8.2	0.28
4	05-23-74	24	7.01	906346.	94942.	119.6	10.5	1573.9	188.3	0.1	7.9	196.2	6.81
5	06-20-74	52	1.22	157608.	1844.	1.8	1.17	1482.0	2.7	0.2	0.5	3.2	0.11
6	06-27-74	59	5.39	696244.	152923.	294.4	22.0	1054.3	310.3	2.4	371.1	681.4	23.6
7	06-27-74	59	5.44	702838.	386371.	962.2	55.0	921.0	886.2	0.1	54.7	940.9	32.6
8	07-24-74	86	1.47	190449.	19149.	30.4	10.1	669.0	20.4	0.1	2.5	22.9	0.79
9	07-27-74	89	7.21	932721.	587874.	859.6	63.0	519.9	446.9	0.1	45.6	492.5	17.1
10	08-10-74	103	2.85	367839.	28215.	29.3	7.67	536.1	15.7	0.1	2.8	18.5	0.64
11	08-16-74	109	5.00	646984.	106941.	91.9	16.5	570.8	52.4	0.1	9.6	62.0	2.15
12	08-17-74	110	1.52	197043.	16840.	9.5	8.55	678.0	6.4	0.1	2.0	8.4	0.29
13	08-29-74	122	1.52	197043.	6437.	4.9	3.27	386.0	1.9	0.3	1.9	3.8	0.13
14	09-01-74	125	1.14	147782.	7702.	0.7	5.21	2940.0	2.0	2.1	16.2	18.2	0.63
15	12-15-74	230	3.10	400680.	661.	0.0	0.17			0.2	0.2	0.2	<.01
16	12-19-74	234	2.16	279144.	321.	0.0	0.11			0.7	0.2	0.2	<.01
17	12-29-74	244	2.29	295564.	909.	0.0	0.31			0.4	0.4	0.4	0.01
18	01-10-75	256	2.64	341593.	6110.	4.0	1.79						
19	01-12-75	258	2.29	295564.	7110.	0.2	2.41	3307.5	0.7	0.3	2.5	3.2	0.11
20	01-24-75	270	2.67	344825.	6383.	0.2	1.85	4936.9	0.9	0.3	1.6	2.5	0.09
21	02-04-75	281	3.56	459767.	20459.	2.8	4.45	525.0	1.5	0.3	6.5	8.0	0.28
22	02-24-75	301	2.79	361245.	7801.	4.9	2.16	898.8	4.4	0.2	1.8	6.2	0.22
23	03-13-75	318	9.45	1221691.	597288.	75.6	48.9	1394.8	105.4	0.2	131.3	236.7	8.21
24	03-16-75	321	1.78	229883.	6060.	1.1	2.64	2583.4	3.0	0.1	0.7	3.7	0.13
25	03-18-75	323	2.13	275912.	18972.	0.4	6.88	4848.7	1.8	0.2	3.0	4.8	0.17
26	04-02-75	338	6.48	837432.	213506.	29.0	25.5	807.4	23.4	0.2	37.7	61.1	2.12
27	05-07-75	373	4.32	558288.	36425.	144.5	6.52	287.9	41.6	0.2	6.4	48.0	1.67
28	05-14-75	380	1.78	229883.	16924.	54.0	7.36	537.0	29.0	0.1	1.5	30.5	1.06
29	05-16-75	382	1.73	223290.	10125.	35.8	4.53	541.8	19.4	0.1	0.8	20.2	0.70
TOTAL			96.39	12463222.	2441211.	2801.2	----	--------	2172.2	-------	709.7	2881.9	----

TABLE H7. CHLORIDE RUNOFF SUMMARY, WATERSHED P4, 1974

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. NUTRIENT IN SED. (PPM)	TOTAL NUTRIENT IN SED. (GRAMS)	MN. CONC. NUTRIENT IN WATER (PPM)	TOTAL NUTRIENT IN WATER (GRAMS)	TOTAL AMOUNT OF NUTRIENT (GRAMS)	% OF SEASON TOTAL LOSS
1	05-23-74	24	6.88	968018.	26621.	6.8	2.75	--------	--------	35.3	938.8	938.8	15.1
2	06-27-74	59	5.33	750168.	89498.	90.2	11.9	--------	--------	2.6	232.2	232.2	3.73
3	06-27-74	59	3.30	464390.	221440.	345.8	47.7	--------	--------	2.9	639.3	639.3	10.3
4	07-27-74	89	7.65	1075184.	366917.	121.2	34.1	--------	--------	3.4	1239.2	1239.2	19.9
5	08-16-74	109	4.44	625140.	68908.	41.0	11.0	--------	--------	3.2	223.2	223.2	3.58
6	08-29-74	122	2.54	357223.	5024.	2.7	1.41	--------	--------	9.1	45.7	45.7	0.73
7	12-15-74	230	3.18	446529.	674.	0.7	0.15	--------	--------	8.4	5.7	5.7	0.09
8	12-19-74	234	2.16	303640.	491.	2.6	0.16	--------	--------	6.0	2.9	2.9	0.05
9	12-29-74	244	2.29	321501.	7078.	5.2	2.20	--------	--------	4.5	32.1	32.1	0.52
10	01-10-75	256	2.46	346534.	36758.	72.1	10.6	--------	--------	2.5	92.1	92.1	1.48
11	01-12-75	258	3.12	439356.	112355.	114.0	25.6	--------	--------	2.1	236.5	236.5	3.80
12	01-24-75	270	1.27	178612.	45262.	42.1	25.3	--------	--------	1.3	57.7	57.7	0.93
13	02-04-75	281	0.0 *	0.*	71502.	33.5		--------	--------	0.8	59.7	59.7	0.96
14	02-16-75	293	2.62	367911.	5429.	3.8	1.48	--------	--------	4.9	26.6	26.6	0.43
15	02-16-75	293	1.52	214334.	12967.	9.5	6.05	--------	--------	3.7	48.6	48.6	0.78
16	02-18-75	295	4.42	621624.	179207.	146.6	28.8	--------	--------	1.3	235.8	235.8	3.79
17	02-24-75	301	2.41	339362.	69050.	51.8	20.3	--------	--------	2.6	176.1	176.1	2.83
18	03-13-75	318	10.01	1407514.	769875.	434.2	54.7	--------	--------	1.9	1444.2	1444.2	23.2
19	03-16-75	321	1.78	250056.	12630.	5.8	5.05	--------	--------	3.6	45.5	45.5	0.73
20	03-18-75	323	2.82	396461.	95711.	30.7	24.1	--------	--------	1.3	120.7	120.7	1.94
21	03-24-75	329	2.64	371568.	41617.	20.4	11.2	--------	--------	3.6	150.2	150.2	2.41
22	04-02-75	338	6.98	982362.	113.	0.0	0.01	--------	--------	5.1	0.6	0.6	<.01
23	05-07-75	373	2.79	392945.	26237.	55.6	6.68	--------	--------	6.6	173.2	173.2	2.78
TOTAL			82.63	11620430.	2265363.	1636.3	----	--------	--------	-------	6226.6	6226.6	----

* ---- RAIN GAUGE STOPPED

TABLE H8. NH_4+N RUNOFF SUMMARY, WATERSHED P4, 1974

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. NUTRIENT IN SED. (PPM)	TOTAL NUTRIENT IN SED. (GRAMS)	MN. CONC. NUTRIENT IN WATER (PPM)	TOTAL NUTRIENT IN WATER (GRAMS)	TOTAL AMOUNT OF NUTRIENT (GRAMS)	% OF SEASON TOTAL LOSS
1	05-23-74	24	6.88	968018.	26621.	6.8	2.75	1406.8	9.5	2.1	55.6	65.1	2.33
2	06-27-74	59	5.33	750168.	89498.	90.2	11.9			2.5	221.2	221.2	7.90
3	06-27-74	59	3.30	464390.	221440.	345.8	47.7	141.0	48.8	2.7	589.4	638.2	22.8
4	07-27-74	89	7.65	1075184.	366917.	121.2	34.1	1066.8	129.3	0.2	86.8	216.1	7.72
5	08-16-74	109	4.44	625140.	68908.	41.0	11.0	904.8	37.1	0.2	12.1	49.2	1.76
6	08-29-74	122	2.54	357223.	5024.	2.7	1.41	1200.0	3.2	0.0	0.0	3.2	0.11
7	12-15-74	230	3.18	446529.	674.	0.7	0.15			0.3	0.2	0.2	<.01
8	12-19-74	234	2.16	303640.	491.	2.6	0.16			0.0	0.0	0.0	0.0
9	12-29-74	244	2.29	321501.	7078.	5.2	2.20			0.0	0.3	0.3	0.01
10	01-10-75	256	2.46	346534.	36758.	72.1	10.6	462.7	33.4	0.1	3.7	37.1	1.33
11	01-12-75	258	3.12	439356.	112355.	114.0	25.6	292.6	33.4	0.1	12.6	46.0	1.64
12	01-24-75	270	1.27	178612.	45262.	42.1	25.3	207.1	8.7	0.2	10.3	19.0	0.68
13	02-04-75	281	0.0 *	0.*	71502.	33.5		458.9	15.4	0.2	13.1	28.5	1.02
14	02-16-75	293	2.62	367911.	5429.	3.8	1.48	429.0	1.6	0.0	0.0	1.6	0.06
15	02-16-75	293	1.52	214334.	12967.	9.5	6.05	380.9	3.6	0.0	0.0	3.6	0.13
16	02-18-75	295	4.42	621624.	179207.	146.6	28.8	970.4	142.3	0.0	0.0	142.3	5.08
17	02-24-75	301	2.41	339362.	69050.	51.8	20.3	13234.6	685.4	0.0	0.0	685.4	24.5
18	03-13-75	318	10.01	1407514.	769875.	434.2	54.7	296.6	128.8	0.1	108.0	236.8	8.46
19	03-16-75	321	1.78	250056.	12630.	5.8	5.05	29549.0	172.0	0.2	2.7	174.7	6.24
20	03-18-75	323	2.82	396461.	95711.	30.7	24.1	5320.9	163.6	0.4	33.9	197.5	7.06
21	03-24-75	329	2.64	371568.	41617.	20.4	11.2	612.2	12.5	0.1	4.2	16.7	0.60
22	04-02-75	338	6.98	982362.	113.	0.0	0.01	1876.0	0.1	1.7	0.2	0.3	0.01
23	05-07-75	373	2.79	392945.	26237.	55.6	6.68	94.0	5.2	0.4	10.5	15.7	0.56
TOTAL			82.63	11620430.	2265363.	1636.3	----	--------	1633.9	-------	1164.8	2798.7	----

* ---- RAIN GAUGE STOPPED

TABLE H9. NO_3-N RUNOFF SUMMARY, WATERSHED P4, 1974

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. NUTRIENT IN SED. (PPM)	TOTAL NUTRIENT IN SED. (GRAMS)	MN. CONC. NUTRIENT IN WATER (PPM)	TOTAL NUTRIENT IN WATER (GRAMS)	TOTAL AMOUNT OF NUTRIENT (GRAMS)	% OF SEASON TOTAL LOSS
1	05-23-74	24	6.88	968018.	26621.	6.8	2.75	--------	--------	2.4	64.8	64.8	5.09
2	06-27-74	59	5.33	750168.	89498.	90.2	11.9	--------	--------	2.1	188.8	188.8	14.8
3	06-27-74	59	3.30	464390.	221440.	345.8	47.7	--------	--------	2.7	588.3	588.3	46.2
4	07-27-74	89	7.65	1075184.	366917.	121.2	34.1	--------	--------	0.4	143.7	143.7	11.3
5	08-16-74	109	4.44	625140.	68908.	41.0	11.0	--------	--------	0.8	57.4	57.4	4.51
6	08-29-74	122	2.54	357223.	5024.	2.7	1.41	--------	--------	0.3	1.5	1.5	0.12
7	12-15-74	230	3.18	446529.	674.	0.7	0.15	--------	--------	1.5	1.0	1.0	0.08
8	12-19-74	234	2.16	303640.	491.	2.6	0.16	--------	--------	1.3	0.6	0.6	0.05
9	12-29-74	244	2.29	321501.	7078.	5.2	2.20	--------	--------	0.4	2.9	2.9	0.23
10	01-10-75	256	2.46	346534.	36758.	72.1	10.6	--------	--------	0.2	5.8	5.8	0.46
11	01-12-75	258	3.12	439356.	112355.	114.0	25.6	--------	--------	0.1	11.2	11.2	0.88
12	01-24-75	270	1.27	178612.	45262.	42.1	25.3	--------	--------	0.1	4.5	4.5	0.35
13	02-04-75	281	0.0 *	0.*	71502.	33.5		--------	--------	0.1	7.2	7.2	0.57
14	02-16-75	293	2.62	367911.	5429.	3.8	1.48	--------	--------	1.0	5.4	5.4	0.42
15	02-16-75	293	1.52	214334.	12967.	9.5	6.05	--------	--------	0.7	8.6	8.6	0.68
16	02-18-75	295	4.42	621624.	179207.	146.6	28.8	--------	--------	0.1	17.9	17.9	1.41
17	02-24-75	301	2.41	339362.	69050.	51.8	20.3	--------	--------	0.1	9.1	9.1	0.72
18	03-13-75	318	10.01	1407514.	769875.	434.2	54.7	--------	--------	0.1	77.0	77.0	6.05
19	03-16-75	321	1.78	250056.	12630.	5.8	5.05	--------	--------	0.6	7.4	7.4	0.58
20	03-18-75	323	2.82	396461.	95711.	30.7	24.1	--------	--------	0.3	28.1	28.1	2.21
21	03-24-75	329	2.64	371568.	41617.	20.4	11.2	--------	--------	0.3	12.5	12.5	0.98
22	04-02-75	338	6.98	982362.	113.	0.0	0.01	--------	--------	0.2	0.0	0.0	0.0
23	05-07-75	373	2.79	392945.	26237.	55.6	6.68	--------	--------	1.1	28.9	28.9	2.27
TOTAL			82.63	11620430.	2265363.	1636.3	----	--------	--------	-------	1272.6	1272.6	----

* ---- RAIN GAUGE STOPPED

TABLE H10. PO_4-P RUNOFF SUMMARY, WATERSHED P4, 1974

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. NUTRIENT IN SED. (PPM)	TOTAL NUTRIENT IN SED. (GRAMS)	MN. CONC. NUTRIENT IN WATER (PPM)	TOTAL NUTRIENT IN WATER (GRAMS)	TOTAL AMOUNT OF NUTRIENT (GRAMS)	% OF SEASON TOTAL LOSS
1	05-23-74	24	6.88	968018.	26621.	6.8	2.75	--------	--------	0.3	8.5	8.5	2.25
2	06-27-74	59	5.33	750168.	89498.	90.2	11.9	--------	--------	0.3	23.6	23.6	6.24
3	06-27-74	59	3.30	464390.	221440.	345.8	47.7	--------	--------	0.1	17.4	17.4	4.60
4	07-27-74	89	7.65	1075184.	366917.	121.2	34.1	--------	--------	0.1	23.5	23.5	6.21
5	08-16-74	109	4.44	625140.	68908.	41.0	11.0	--------	--------	0.2	11.6	11.6	3.07
6	08-29-74	122	2.54	357223.	5024.	2.7	1.41	--------	--------	0.7	3.8	3.8	1.00
7	12-15-74	230	3.18	446529.	674.	0.7	0.15	--------	--------	0.4	0.3	0.3	0.08
8	12-19-74	234	2.16	303640.	491.	2.6	0.16	--------	--------	0.5	0.2	0.2	0.05
9	12-29-74	244	2.29	321501.	7078.	5.2	2.20	--------	--------	0.3	1.8	1.8	0.48
10	01-10-75	256	2.46	346534.	36758.	72.1	10.6	--------	--------	0.3	12.5	12.5	3.31
11	01-12-75	258	3.12	439356.	112355.	114.0	25.6	--------	--------	0.3	29.3	29.3	7.75
12	01-24-75	270	1.27	178612.	45262.	42.1	25.3	--------	--------	0.2	11.0	11.0	2.91
13	02-04-75	281	0.0 *	0.*	71502.	33.5		--------	--------	0.2	16.1	16.1	4.26
14	02-16-75	293	2.62	367911.	5429.	3.8	1.48	--------	--------	0.1	0.8	0.8	0.21
15	02-16-75	293	1.52	214334.	12967.	9.5	6.05	--------	--------	0.2	2.3	2.3	0.61
16	02-18-75	295	4.42	621624.	179207.	146.6	28.8	--------	--------	0.2	28.4	28.4	7.51
17	02-24-75	301	2.41	339362.	69050.	51.8	20.3	--------	--------	0.2	13.4	13.4	3.54
18	03-13-75	318	10.01	1407514.	769875.	434.2	54.7	--------	--------	0.2	137.9	137.9	36.5
19	03-16-75	321	1.78	250056.	12630.	5.8	5.05	--------	--------	0.2	2.4	2.4	0.63
20	03-18-75	323	2.82	396461.	95711.	30.7	24.1	--------	--------	0.1	12.1	12.1	3.20
21	03-24-75	329	2.64	371568.	41617.	20.4	11.2	--------	--------	0.2	7.2	7.2	1.90
22	04-02-75	338	6.98	982362.	113.	0.0	0.01	--------	--------	0.1	0.0	0.0	0.0
23	05-07-75	373	2.79	392945.	26237.	55.6	6.68	--------	--------	0.5	14.1	14.1	3.73
TOTAL			82.63	11620430.	2265363.	1636.3	----	--------	--------	--------	378.2	378.2	----

* ---- RAIN GAUGE STOPPED

TABLE H11. TKN RUNOFF SUMMARY, WATERSHED P4, 1974

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. NUTRIENT IN SED. (PPM)	TOTAL NUTRIENT IN SED. (GRAMS)	MN. CONC. NUTRIENT IN WATER (PPM)	TOTAL NUTRIENT IN WATER (GRAMS)	TOTAL AMOUNT OF NUTRIENT (GRAMS)	% OF SEASON TOTAL LOSS
1	05-23-74	24	6.88	968018.	26621.	6.8	2.75	341.9	2.3	2.9	78.0	80.3	0.96
2	06-27-74	59	5.33	750168.	89498.	90.2	11.9			4.3	385.4	385.4	4.61
3	06-27-74	59	3.30	464390.	221440.	345.8	47.7	2232.8	772.0	3.9	868.5	1640.5	19.6
4	07-27-74	89	7.65	1075184.	366917.	121.2	34.1	2075.6	251.6	1.5	552.2	803.8	9.62
5	08-16-74	109	4.44	625140.	68908.	41.0	11.0	2905.2	119.0	1.5	102.0	221.0	2.64
6	08-29-74	122	2.54	357223.	5024.	2.7	1.41	4520.0	12.0	2.6	13.3	25.3	0.30
7	12-15-74	230	3.18	446529.	674.	0.7	0.15			3.3	2.2	2.2	0.03
8	12-19-74	234	2.16	303640.	491.	2.6	0.16			3.0	1.5	1.5	0.02
9	12-29-74	244	2.29	321501.	7078.	5.2	2.20			3.6	25.5	25.5	0.31
10	01-10-75	256	2.46	346534.	36758.	72.1	10.6	2252.1	162.4	2.2	79.5	241.9	2.89
11	01-12-75	258	3.12	439356.	112355.	114.0	25.6	2631.4	300.0	2.3	255.2	555.2	6.64
12	01-24-75	270	1.27	178612.	45262.	42.1	25.3	990.5	41.7	1.6	74.5	116.2	1.39
13	02-04-75	281	0.0 *	0.*	71502.	33.5		1640.5	55.0	0.8	58.5	113.5	1.36
14	02-16-75	293	2.62	367911.	5429.	3.8	1.48	543.0	2.1	2.4	13.0	15.1	0.18
15	02-16-75	293	1.52	214334.	12967.	9.5	6.05	1014.1	9.6	2.6	33.6	43.2	0.52
16	02-18-75	295	4.42	621624.	179207.	146.6	28.8	6491.8	951.9	0.6	100.4	1052.3	12.6
17	02-24-75	301	2.41	339362.	69050.	51.8	20.3	2562.5	132.7	1.9	132.0	264.7	3.17
18	03-13-75	318	10.01	1407514.	769875.	434.2	54.7	2969.0	1289.0	1.2	922.8	2211.8	26.5
19	03-16-75	321	1.78	250056.	12630.	5.8	5.05	5972.1	34.8	2.9	36.9	71.7	0.86
20	03-18-75	323	2.82	396461.	95711.	30.7	24.1	4287.1	131.8	1.8	167.5	299.3	3.58
21	03-24-75	329	2.64	371568.	41617.	20.4	11.2	2140.1	43.6	2.0	81.6	125.2	1.50
22	04-02-75	338	6.98	982362.	113.	0.0	0.01	5687.7	0.2	2.7	0.3	0.5	<.01
23	05-07-75	373	2.79	392945.	26237.	55.6	6.68	189.0	10.5	1.9	49.9	60.4	0.72
TOTAL			82.63	11620430.	2265363.	1636.3	----	--------	4322.2	-------	4034.3	8356.5	----

* ---- RAIN GAUGE STOPPED

TABLE H12. TOTAL-P RUNOFF SUMMARY, WATERSHED P4, 1974

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. NUTRIENT IN SED. (PPM)	TOTAL NUTRIENT IN SED. (GRAMS)	MN. CONC. NUTRIENT IN WATER (PPM)	TOTAL NUTRIENT IN WATER (GRAMS)	TOTAL AMOUNT OF NUTRIENT (GRAMS)	% OF SEASON TOTAL LOSS
1	05-23-74	24	6.88	968018.	26621.	6.8	2.75	714.8	4.8	0.3	9.1	13.9	0.92
2	06-27-74	59	5.33	750168.	89498.	90.2	11.9	500.3	45.1	0.3	26.6	71.7	4.75
3	06-27-74	59	3.30	464390.	221440.	345.8	47.7	545.5	188.6	0.1	28.7	217.3	14.4
4	07-27-74	89	7.65	1075184.	366917.	121.2	34.1	748.9	90.8	0.1	27.9	118.7	7.86
5	08-16-74	109	4.44	625140.	68908.	41.0	11.0	431.4	17.7	0.2	12.7	30.4	2.01
6	08-29-74	122	2.54	357223.	5024.	2.7	1.41	888.0	2.4	0.7	3.3	5.7	0.38
7	12-15-74	230	3.18	446529.	674.	0.7	0.15			0.1	0.1	0.1	<.01
8	12-19-74	234	2.16	303640.	491.	2.6	0.16			0.6	0.3	0.3	0.02
9	12-29-74	244	2.29	321501.	7078.	5.2	2.20			0.3	2.2	2.2	0.15
10	01-10-75	256	2.46	346534.	36758.	72.1	10.6	805.0	58.0	0.4	13.9	71.9	4.76
11	01-12-75	258	3.12	439356.	112355.	114.0	25.6	775.7	88.4	0.3	37.3	125.7	8.32
12	01-24-75	270	1.27	178612.	45262.	42.1	25.3	951.4	40.1	0.4	16.7	56.8	3.76
13	02-04-75	281	0.0 *	0.*	71502.	33.5		315.4	10.6	0.3	24.6	35.2	2.33
14	02-16-75	293	2.62	367911.	5429.	3.8	1.48	139.0	0.5	0.2	1.1	1.6	0.11
15	02-16-75	293	1.52	214334.	12967.	9.5	6.05	243.6	2.3	0.2	2.7	5.0	0.33
16	02-18-75	295	4.42	621624.	179207.	146.6	28.8	466.4	68.4	0.3	51.4	119.8	7.93
17	02-24-75	301	2.41	339362.	69050.	51.8	20.3	809.7	41.9	0.2	12.9	54.8	3.63
18	03-13-75	318	10.01	1407514.	769875.	434.2	54.7	556.5	241.6	0.3	216.1	457.7	30.3
19	03-16-75	321	1.78	250056.	12630.	5.8	5.05	942.1	5.5	0.2	2.1	7.6	0.50
20	03-18-75	323	2.82	396461.	95711.	30.7	24.1	1541.5	47.4	0.1	14.2	61.6	4.08
21	03-24-75	329	2.64	371568.	41617.	20.4	11.2	721.2	14.7	0.1	6.1	20.8	1.38
22	04-02-75	338	6.98	982362.	113.	0.0	0.01	406.8	0.0	0.2	0.0	0.0	0.0
23	05-07-75	373	2.79	392945.	26237.	55.6	6.68	460.0	25.6	0.2	5.9	31.5	2.09
TOTAL			82.63	11620430.	2265363.	1636.3	----	--------	994.4	-------	515.9	1510.3	----

* ---- RAIN GAUGE STOPPED

TABLE H13. CHLORIDE RUNOFF SUMMARY, WATERSHED P2, 1975

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. NUTRIENT IN SED. (PPM)	TOTAL NUTRIENT IN SED. (GRAMS)	MN. CONC. NUTRIENT IN WATER (PPM)	TOTAL NUTRIENT IN WATER (GRAMS)	TOTAL AMOUNT OF NUTRIENT (GRAMS)	% OF SEASON TOTAL LOSS
1	05-31-75	10	3.61	466361.	51767.	280.6	11.1	--------	--------	7.5	390.0	390.0	12.8
2	06-11-75	21	2.41	311985.	95552.	383.5	30.6	--------	--------	1.9	177.5	177.5	5.81
3	06-11-75	21	4.70	607549.	432969.	4975.7	71.3	--------	--------	2.8	1231.0	1231.0	40.3
4	06-19-75	29	0.63	82101.	13898.	2.8	16.9	--------	--------	4.9	68.1	68.1	2.23
5	07-13-75	53	2.67	344825.	104437.	416.8	30.3	--------	--------	1.9	200.6	200.6	6.57
6	07-24-75	64	4.32	558288.	313363.	556.3	56.1	--------	--------	2.6	808.7	808.7	26.5
7	08-01-75	72	0.89	114942.	15140.	9.7	13.2	--------	--------	3.8	58.2	58.2	1.91
8	08-26-75	97	2.97	384260.	5951.	4.9	1.55	--------	--------	13.0	77.4	77.4	2.53
9	09-17-75	119	5.08	656810.	72527.	86.7	11.0	--------	--------	0.3	24.4	24.4	0.80
10	09-22-75	124	3.48	449941.	52680.	23.9	11.7	--------	--------	0.0	0.6	0.6	0.02
11	09-23-75	125	1.14	147782.	12422.	7.6	8.41	--------	--------	1.5	18.4	18.4	0.60
TOTAL			31.90	4124843.	1170706.	6748.5	----	--------	--------	-------	3054.9	3054.9	----

TABLE H14. NH_4+N RUNOFF SUMMARY, WATERSHED P2, 1975

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. NUTRIENT IN SED. (PPM)	TOTAL NUTRIENT IN SED. (GRAMS)	MN. CONC. NUTRIENT IN WATER (PPM)	TOTAL NUTRIENT IN WATER (GRAMS)	TOTAL AMOUNT OF NUTRIENT (GRAMS)	% OF SEASON TOTAL LOSS
1	05-31-75	10	3.61	466361.	51767.	280.6	11.1	365.2	102.5	0.5	28.1	130.6	5.08
2	06-11-75	21	2.41	311985.	95552.	383.5	30.6	108.4	41.6	0.2	22.7	64.3	2.50
3	06-11-75	21	4.70	607549.	432969.	4975.7	71.3	131.9	656.3	0.3	119.9	776.2	30.2
4	06-19-75	29	0.63	82101.	13898.	2.8	16.9	5000.0	13.9	0.4	5.6	19.5	0.76
5	07-13-75	53	2.67	344825.	104437.	416.8	30.3	928.9	387.2	2.1	214.4	601.6	23.4
6	07-24-75	64	4.32	558288.	313363.	556.3	56.1	633.2	352.3	1.0	302.8	655.1	25.5
7	08-01-75	72	0.89	114942.	15140.	9.7	13.2	1254.7	12.1	1.1	17.3	29.4	1.14
8	08-26-75	97	2.97	384260.	5951.	4.9	1.55	610.0	3.0	1.1	6.5	9.5	0.37
9	09-17-75	119	5.08	656810.	72527.	86.7	11.0	1470.9	127.5	0.3	21.8	149.3	5.81
10	09-22-75	124	3.48	449941.	52680.	23.9	11.7	3497.4	83.6	0.3	17.0	100.6	3.91
11	09-23-75	125	1.14	147782.	12422.	7.6	8.41	3668.7	27.9	0.5	6.2	34.1	1.33
TOTAL			31.90	4124843.	1170706.	6748.5	----	--------	1807.9	-------	762.3	2570.2	----

TABLE H15. NO_3-N RUNOFF SUMMARY, WATERSHED P2, 1975

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. NUTRIENT IN SED. (PPM)	TOTAL NUTRIENT IN SED. (GRAMS)	MN. CONC. NUTRIENT IN WATER (PPM)	TOTAL NUTRIENT IN WATER (GRAMS)	TOTAL AMOUNT OF NUTRIENT (GRAMS)	% OF SEASON TOTAL LOSS
1	05-31-75	10	3.61	466361.	51767.	280.6	11.1	--------	--------	0.7	37.8	37.8	4.32
2	06-11-75	21	2.41	311985.	95552.	383.5	30.6	--------	--------	1.0	98.4	98.4	11.3
3	06-11-75	21	4.70	607549.	432969.	4975.7	71.3	--------	--------	0.6	265.9	265.9	30.4
4	06-19-75	29	0.63	82101.	13898.	2.8	16.9	--------	--------	1.7	23.6	23.6	2.70
5	07-13-75	53	2.67	344825.	104437.	416.8	30.3	--------	--------	1.1	112.1	112.1	12.8
6	07-24-75	64	4.32	558288.	313363.	556.3	56.1	--------	--------	0.4	126.4	126.4	14.5
7	08-01-75	72	0.89	114942.	15140.	9.7	13.2	--------	--------	1.0	15.1	15.1	1.73
8	08-26-75	97	2.97	384260.	5951.	4.9	1.55	--------	--------	20.0	119.0	119.0	13.6
9	09-17-75	119	5.08	656810.	72527.	86.7	11.0	--------	--------	0.6	46.5	46.5	5.32
10	09-22-75	124	3.48	449941.	52680.	23.9	11.7	--------	--------	0.3	17.0	17.0	1.94
11	09-23-75	125	1.14	147782.	12422.	7.6	8.41	--------	--------	1.0	12.3	12.3	1.41
TOTAL			31.90	4124843.	1170706.	6748.5	----	--------	--------	-------	874.1	874.1	----

TABLE H16. PO_4-P RUNOFF SUMMARY, WATERSHED P2, 1975

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. NUTRIENT IN SED. (PPM)	TOTAL NUTRIENT IN SED. (GRAMS)	MN. CONC. NUTRIENT IN WATER (PPM)	TOTAL NUTRIENT IN WATER (GRAMS)	TOTAL AMOUNT OF NUTRIENT (GRAMS)	% OF SEASON TOTAL LOSS
1	05-31-75	10	3.61	466361.	51767.	280.6	11.1	--------	--------	0.1	5.0	5.0	4.61
2	06-11-75	21	2.41	311985.	95552.	383.5	30.6	--------	--------	0.1	5.7	5.7	5.25
3	06-11-75	21	4.70	607549.	432969.	4975.7	71.3	--------	--------	0.1	48.5	48.5	44.7
4	06-19-75	29	0.63	82101.	13898.	2.8	16.9	--------	--------	0.1	1.0	1.0	0.92
5	07-13-75	53	2.67	344825.	104437.	416.8	30.3	--------	--------	0.1	8.2	8.2	7.56
6	07-24-75	64	4.32	558288.	313363.	556.3	56.1	--------	--------	0.0	14.5	14.5	13.4
7	08-01-75	72	0.89	114942.	15140.	9.7	13.2	--------	--------	0.2	2.9	2.9	2.67
8	08-26-75	97	2.97	384260.	5951.	4.9	1.55	--------	--------	0.5	3.2	3.2	2.95
9	09-17-75	119	5.08	656810.	72527.	86.7	11.0	--------	--------	0.1	9.2	9.2	8.48
10	09-22-75	124	3.48	449941.	52680.	23.9	11.7	--------	--------	0.1	7.3	7.3	6.73
11	09-23-75	125	1.14	147782.	12422.	7.6	8.41	--------	--------	0.2	3.0	3.0	2.76
TOTAL			31.90	4124843.	1170706.	6748.5	----	--------	--------	-------	108.5	108.5	----

TABLE H17. TKN RUNOFF SUMMARY, WATERSHED P2, 1975

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. NUTRIENT IN SED. (PPM)	TOTAL NUTRIENT IN SED. (GRAMS)	MN. CONC. NUTRIENT IN WATER (PPM)	TOTAL NUTRIENT IN WATER (GRAMS)	TOTAL AMOUNT OF NUTRIENT (GRAMS)	% OF SEASON TOTAL LOSS
1	05-31-75	10	3.61	466361.	51767.	280.6	11.1	485.4	136.2	2.0	101.3	237.5	3.19
2	06-11-75	21	2.41	311985.	95552.	383.5	30.6	1001.9	384.3	1.9	181.5	565.8	7.60
3	06-11-75	21	4.70	607549.	432969.	4975.7	71.3	205.5	1022.6	2.2	960.5	1983.1	26.6
4	06-19-75	29	0.63	82101.	13898.	2.8	16.9	500.0	1.4	3.5	48.6	50.0	0.67
5	07-13-75	53	2.67	344825.	104437.	416.8	30.3	394.2	164.3	2.5	256.2	420.5	5.64
6	07-24-75	64	4.32	558288.	313363.	556.3	56.1	5066.7	2818.7	2.1	666.4	3485.1	46.8
7	08-01-75	72	0.89	114942.	15140.	9.7	13.2	4664.6	45.1	0.9	14.0	59.1	0.79
8	08-26-75	97	2.97	384260.	5951.	4.9	1.55	3171.0	15.5	1.7	10.1	25.6	0.34
9	09-17-75	119	5.08	656810.	72527.	86.7	11.0	687.0	59.5	3.5	256.8	316.3	4.25
10	09-22-75	124	3.48	449941.	52680.	23.9	11.7	658.5	15.7	4.2	222.8	238.5	3.20
11	09-23-75	125	1.14	147782.	12422.	7.6	8.41	448.1	3.4	5.2	64.6	68.0	0.91
TOTAL			31.90	4124843.	1170706.	6748.5	----	--------	4666.7	-------	2782.8	7449.5	----

TABLE H18. TOTAL-P RUNOFF SUMMARY, WATERSHED P2, 1975

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. NUTRIENT IN SED. (PPM)	TOTAL NUTRIENT IN SED. (GRAMS)	MN. CONC. NUTRIENT IN WATER (PPM)	TOTAL NUTRIENT IN WATER (GRAMS)	TOTAL AMOUNT OF NUTRIENT (GRAMS)	% OF SEASON TOTAL LOSS
1	05-31-75	10	3.61	466361.	51767.	280.6	11.1	689.2	193.4	0.1	7.1	200.5	3.68
2	06-11-75	21	2.41	311985.	95552.	383.5	30.6	1997.8	766.2	0.1	6.2	772.4	14.2
3	06-11-75	21	4.70	607549.	432969.	4975.7	71.3	600.4	2987.5	0.1	52.0	3039.5	55.8
4	06-19-75	29	0.63	82101.	13898.	2.8	16.9	21545.0	59.9	0.1	1.3	61.2	1.12
5	07-13-75	53	2.67	344825.	104437.	416.8	30.3	886.7	369.6	0.1	7.8	377.4	6.92
6	07-24-75	64	4.32	558288.	313363.	556.3	56.1	1154.4	642.2	0.1	18.2	660.4	12.1
7	08-01-75	72	0.89	114942.	15140.	9.7	13.2	1716.3	16.6	0.2	2.5	19.1	0.35
8	08-26-75	97	2.97	384260.	5951.	4.9	1.55	1034.0	5.0	0.6	3.3	8.3	0.15
9	09-17-75	119	5.08	656810.	72527.	86.7	11.0	2152.4	186.6	0.2	11.9	198.5	3.64
10	09-22-75	124	3.48	449941.	52680.	23.9	11.7	3103.8	74.2	0.2	8.5	82.7	1.52
11	09-23-75	125	1.14	147782.	12422.	7.6	8.41	3558.8	27.1	0.3	3.2	30.3	0.56
TOTAL			31.90	4124843.	1170706.	6748.5	----	--------	5328.3	-------	122.0	5450.3	----

TABLE H19. CHLORIDE RUNOFF SUMMARY, WATERSHED P4, 1975

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. NUTRIENT IN SED. (PPM)	TOTAL NUTRIENT IN SED. (GRAMS)	MN. CONC. NUTRIENT IN WATER (PPM)	TOTAL NUTRIENT IN WATER (GRAMS)	TOTAL AMOUNT OF NUTRIENT (GRAMS)	% OF SEASON TOTAL LOSS
1	05-31-75	17	3.56	500112.	42140.	107.1	8.43	--------	--------	3.9	164.5	164.5	23.4
2	06-11-75	28	2.67	375084.	212819.	557.4	56.7	--------	--------	1.7	362.4	362.4	51.7
3	06-11-75	28	2.54	357223.	88218.	187.4	24.7	--------	--------	1.8	160.9	160.9	22.9
4	09-23-75	132	4.88	685896.	138125.	81.5	20.1	--------	--------	0.1	13.8	13.8	1.97
TOTAL			13.64	1918315.	481302.	933.4	----	--------	--------	-------	701.6	701.6	----

TABLE H20. NH_4+N RUNOFF SUMMARY, WATERSHED P4, 1975

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. NUTRIENT IN SED. (PPM)	TOTAL NUTRIENT IN SED. (GRAMS)	MN. CONC. NUTRIENT IN WATER (PPM)	TOTAL NUTRIENT IN WATER (GRAMS)	TOTAL AMOUNT OF NUTRIENT (GRAMS)	% OF SEASON TOTAL LOSS
1	05-31-75	17	3.56	500112.	42140.	107.1	8.43	625.8	67.0	0.4	16.9	83.9	12.5
2	06-11-75	28	2.67	375084.	212819.	557.4	56.7	332.3	185.2	0.2	43.1	228.3	34.0
3	06-11-75	28	2.54	357223.	88218.	187.4	24.7	124.1	23.3	0.2	17.6	40.9	6.10
4	09-23-75	132	4.88	685896.	138125.	81.5	20.1	3390.0	276.3	0.3	41.4	317.7	47.4
TOTAL			13.64	1918315.	481302.	933.4	----	--------	551.8	-------	119.0	670.8	----

TABLE H21. NO_3-N RUNOFF SUMMARY, WATERSHED P4, 1975

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. NUTRIENT IN SED. (PPM)	TOTAL NUTRIENT IN SED. (GRAMS)	MN. CONC. NUTRIENT IN WATER (PPM)	TOTAL NUTRIENT IN WATER (GRAMS)	TOTAL AMOUNT OF NUTRIENT (GRAMS)	% OF SEASON TOTAL LOSS
1	05-31-75	17	3.56	500112.	42140.	107.1	8.43	--------	--------	1.4	60.1	60.1	26.6
2	06-11-75	28	2.67	375084.	212819.	557.4	56.7	--------	--------	0.2	49.8	49.8	22.1
3	06-11-75	28	2.54	357223.	88218.	187.4	24.7	--------	--------	0.7	60.6	60.6	26.8
4	09-23-75	132	4.88	685896.	138125.	81.5	20.1	--------	--------	0.4	55.2	55.2	24.5
TOTAL			13.64	1918315.	481302.	933.4	----	--------	--------	-------	225.7	225.7	----

TABLE H22. PO_4-P RUNOFF SUMMARY, WATERSHED P4, 1975

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. NUTRIENT IN SED. (PPM)	TOTAL NUTRIENT IN SED. (GRAMS)	MN. CONC. NUTRIENT IN WATER (PPM)	TOTAL NUTRIENT IN WATER (GRAMS)	TOTAL AMOUNT OF NUTRIENT (GRAMS)	% OF SEASON TOTAL LOSS
1	05-31-75	17	3.56	500112.	42140.	107.1	8.43	--------	--------	0.3	13.1	13.1	13.2
2	06-11-75	28	2.67	375084.	212819.	557.4	56.7	--------	--------	0.2	32.3	32.3	32.6
3	06-11-75	28	2.54	357223.	88218.	187.4	24.7	--------	--------	0.2	16.1	16.1	16.2
4	09-23-75	132	4.88	685896.	138125.	81.5	20.1	--------	--------	0.3	37.6	37.6	37.9
TOTAL			13.64	1918315.	481302.	933.4	----	--------	--------	-------	99.1	99.1	----

TABLE H23. TKN RUNOFF SUMMARY, WATERSHED P4, 1975

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. NUTRIENT IN SED. (PPM)	TOTAL NUTRIENT IN SED. (GRAMS)	MN. CONC. NUTRIENT IN WATER (PPM)	TOTAL NUTRIENT IN WATER (GRAMS)	TOTAL AMOUNT OF NUTRIENT (GRAMS)	% OF SEASON TOTAL LOSS
1	05-31-75	17	3.56	500112.	42140.	107.1	8.43	471.4	50.5	1.7	71.2	121.7	6.59
2	06-11-75	28	2.67	375084.	212819.	557.4	56.7	339.5	189.2	1.7	364.7	553.9	30.0
3	06-11-75	28	2.54	357223.	88218.	187.4	24.7	146.3	27.4	2.1	189.6	217.0	11.8
4	09-23-75	132	4.88	685896.	138125.	81.5	20.1	2373.0	193.4	5.5	759.7	953.1	51.6
TOTAL			13.64	1918315.	481302.	933.4	----	--------	460.5	-------	1385.2	1845.7	----

TABLE H24. TOTAL-P RUNOFF SUMMARY, WATERSHED P4, 1975

RUNOFF EVENT NO.	EVENT DATE	DAYS AFTER PLANTING	RAIN GAUGE (CM)	TOTAL RAINFALL (LITERS)	TOTAL RUNOFF (LITERS)	TOTAL SEDIMENT (KG)	RUNOFF %	MN. CONC. NUTRIENT IN SED. (PPM)	TOTAL NUTRIENT IN SED. (GRAMS)	MN. CONC. NUTRIENT IN WATER (PPM)	TOTAL NUTRIENT IN WATER (GRAMS)	TOTAL AMOUNT OF NUTRIENT (GRAMS)	% OF SEASON TOTAL LOSS
1	05-31-75	17	3.56	500112.	42140.	107.1	8.43	1076.3	115.3	0.3	14.2	129.5	9.74
2	06-11-75	28	2.67	375084.	212819.	557.4	56.7	1093.4	609.5	0.2	35.3	644.8	48.5
3	06-11-75	28	2.54	357223.	88218.	187.4	24.7	1117.2	209.4	0.2	14.9	224.3	16.9
4	09-23-75	132	4.88	685896.	138125.	81.5	20.1	3585.0	292.2	0.3	39.4	331.6	24.9
TOTAL			13.64	1918315.	481302.	933.4	----	--------	1226.4	-------	103.8	1330.2	----

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA-600/3-78-056	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Transport of Agricultural Chemicals from Small Upland Piedmont Watersheds		5. REPORT DATE May 1978 issuing date 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) C.N. Smith, R.A. Leonard, G.W. Langdale, and G.W. Bailey		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Environmental Research Laboratory Athens, Georgia 30605 and Southern Piedmont Conservation Research Center Watkinsville, Georgia 30677		10. PROGRAM ELEMENT NO. 1HB617 11. CONTRACT/GRANT NO. IAG-D6-0381
12. SPONSORING AGENCY NAME AND ADDRESS Environmental Research Laboratory Athens, GA Office of Research and Development U.S. Environmental Protection Agency Athens, Georgia 30605		13. TYPE OF REPORT AND PERIOD COVERED Final 14. SPONSORING AGENCY CODE EPA/600/01

15. SUPPLEMENTARY NOTES

16. ABSTRACT

Data were collected from four small watersheds (1.3 to 2.7 ha) located in the Southern Piedmont region. Two watersheds were managed without conservation measures; the other two watersheds were parallel-terraced and included grassed waterways for soil erosion control.

Total losses of applied herbicides were affected by the occurrence of runoff in close proximity to application date, mode of application, and persistence in the soil runoff zone. Most of the total annual losses by runoff were in the first three runoff events for all compounds except paraquat. Runoff of trifluralin was very low (0.1 to 0.3% of the annual application). Total runoff losses of other herbicides were commonly less than 1.0% except when runoff occurred shortly after application.

Sediment yield from terraced watersheds was significantly less than from watersheds managed without terraces. Except for paraquat, however, pesticide yields in runoff were not reduced in proportion to sediment reduction because solution transport was the major mode of loss for the soluble herbicide phase.

Annual runoff losses of soluble plant nutrients were 5.0 and 1.3 kg/ha for chloride and nitrate, respectively. Losses of soluble phosphorus from both watersheds were very low, about 380 g/ha.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Herbicides Fertilizers Pesticides Surface Water Runoff	Agricultural Chemicals Agricultural Runoff Agricultural Watersheds Plant Nutrients	48E 48G 68D 98A 98D

18. DISTRIBUTION STATEMENT RELEASE TO PUBLIC	19. SECURITY CLASS *(This Report)* UNCLASSIFIED	21. NO. OF PAGES 386
	20. SECURITY CLASS *(This page)* UNCLASSIFIED	22. PRICE

EPA Form 2220-1 (9-73)

☆ U. S. GOVERNMENT PRINTING OFFICE: 1978-757-140/1346 Region No. 5-II