VALIDATION OF A COUPLED HERBICIDE FATE AND TARGET PLANT SPECIES EFFECTS MODEL

DISSERTATION

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By

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A series of experiments provided data to parameterize and validate a coupled herbicide fate and target plant species effects model. This simulation model is currently designed to predict responses of water hyacinth populations to treatments of the dimethylamine formulation of 2,4-dichloro-phenoxy acetic acid (2,4-D - DMA). Experiments investigated 1) the response of water hyacinth to varying exposures of 2,4-D (DMA); 2) the role of water hyacinth density and herbicide interception in treatment effectiveness using 2,4-D (DMA); and 3) the importance of root exposure to obtain control of water hyacinth using 2,4-D (DMA). Results demonstrated the importance of leaf or canopy interception of 2,4-D (DMA) sprays in obtaining control of water hyacinth populations. The critical threshold plant tissue concentration of 2,4-D (DMA) required to elicit maximum mortality (98%) was estimated to be approximately 12 mg 2,4-D per kg water hyacinth tissue (wet weight). Root uptake apparently plays little or no role in the effectiveness of this herbicide for controlling water

hyacinth growth. Validation trials illustrated the efficacy of the current model. The model was validated with data from a field operation. This research has provided considerable insight into optimal use of this auxin-type herbicide for control of water hyacinth, a monocotyledon.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS CONTINUED

CHAPTER 1

INTRODUCTION

Surface waters in the United States are valuable resources for domestic water supplies, recreation, wildlife habitat, industry, navigation and agriculture. Vascular aquatic plants (macrophytes) comprise an important part of aquatic ecosystems, but dense growths may compromise the utility of water resources. Although many macrophyte species are indigenous to the United States, macrophytes that frequently cause the most serious water resource management problems are exotic species from Europe, Asia, Africa and South America. Eichhornia crassipes (Mart.) Solms, water hyacinth, is an exotic macrophyte that is currently causing water management problems in this country. One common control practice for dense growths of water hyacinths is use of herbicides.

Eichhornia crassipes (water hyacinth)

Eichhornia crassipes (Mart.) Solms (family Pontederiaceae) is commonly called water hyacinth because its flowers resemble those of the hyacinth (family: Liliaceae, genus Hyacinthus). This monocotyledon was

originally classified as Pontederia crassipes by von Martius in 1924 and was later re-classified into the genus Eichhornia by Solms (Count Hermann Maximilian Carl Ludwig Friedrich Solms-Laubach, 1842-1915, professor of botany, Strassburg).

Penfound and Earle (1948) described mature specimens of Eichhornia crassipes as consisting of roots, rhizomes, stolons, leaves, inflorescences and fruit clusters. The rhizomes (vegetative stems) consist of an axis with short internodes which produce the other parts of the plant. The stolons are similar in diameter to the rhizome and function in vegetative production of daughter rosettes (ramets) (Bock, 1969). In uncrowded conditions (e.g. during the early part of the growth season), the leaves of water hyacinths produce hollow, swollen portions which assist the plants in floating on the water surface. The inflorescence of the water hyacinth is a lavender colored spike subtended by two bracts attached to an elongate stalk (peduncle). Mature stands of water hyacinths frequently achieve densities of as much as 340 metric tons/hectare (Penfound and Earle, 1948). The mean dry weight percentage of the plant is approximately 7% (Bock, 1969).

Originally from the Amazon River basin in South America, water hyacinth was collected and distributed virtually world wide during the mid- to late-nineteenth

century because of its ornamental attractiveness. Since that time, water hyacinth has become established throughout the southeastern United States where it dominates many water systems. Most states (Texas included) with suitable habitat for this species have established control programs designed to limit the plant's growth and restore some of the utility of the water resource.

Several techniques are available to control the growth of water hyacinth populations. These control practices include mechanical (such as harvesting), biological (such as the Neochetina weevil and Ctenopharyngodon idella (Chinese grass carp)), and chemical (such as 2,4-D) (Gopal, 1987). This research focused on use of the dimethylamine formulation of 2,4-dichloro-phenoxy acetic acid (2,4-D - DMA) for control of water hyacinth since this is one of the most common control methods used in the United States (Audus, 1976b).

2,4-Dichlorophenoxy Acetic Acid

This herbicide (Figure 1) is usually applied to dicotyledons and acts as a hormone that regulates plant growth, uncouples phosphorylation associated with pyruvate oxidation, stimulates respiration, and lowers the photosynthesis / respiration ratio, ultimately resulting in the death of the plant (Audus 1976b). Since E. crassipes is

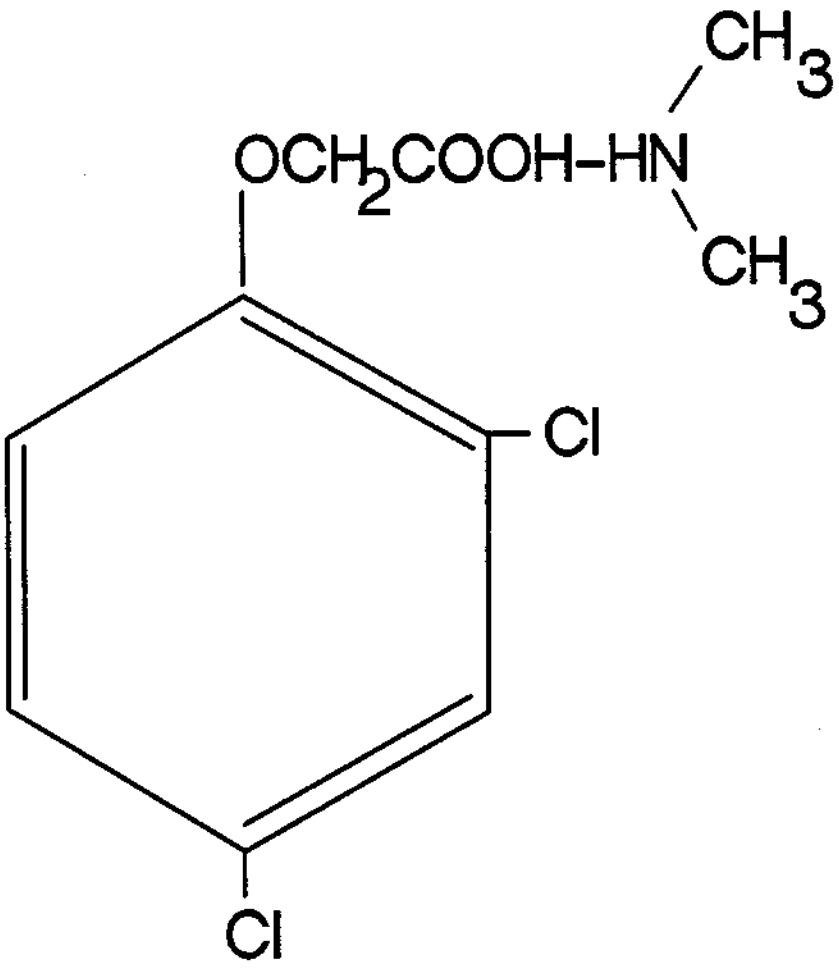

Figure 1. Structure of 2,4-D (DMA).

a monocotyledon, 2,4-D may not function solely as a hormone. Audus (1976a) indicated that monocotyledonous shoots are generally resistant to auxin-type herbicides. When susceptibility does occur, the responses of monocotyledons are similar to those of dicotyledons. Ashton and Crafts (1981) reported that chlorophenoxy compounds cause cessation of apical meristematic cell division, and termination of length increase in elongating cells with continued radial expansion. In mature plant tissues parenchyma cells swell and begin to divide, producing callus tissue. Root elongation stops and root tips swell. Young leaves stop expanding and develop excessive vascular tissue and very compact mesophyll, low in chlorophyll. Roots lose their ability to absorb water and salts, photosynthesis is inhibited, and the phloem becomes plugged.

There is no doubt that 2,4-D is effective for control of water hyacinth since it is widely used for this purpose, but no clear understanding of the mode of action of the herbicide on this species currently exists. A more complete understanding of the use of 2,4-D for controlling water hyacinth may lead to more effective application, use, and ultimately less expensive control of this common water resource problem.

Control of *Eichhornia crassipes* with 2,4-D

An area of primary concern in management of waters that are plagued with excessive growths of aquatic vegetation is efficient use of the relatively few herbicides that are registered for use in these aquatic systems. In the past few years, managers of lakes, reservoirs, canals, rivers, and streams have been faced with the problems of a shrinking list of available herbicides and concerned and cautious citizens. Extensive and expensive testing is required before a herbicide can be registered and marketed under the Federal Insecticide Fungicide and Rodenticide Act (FIFRA). Consequently, few new herbicides are developed or marketed and managers are faced with fewer chemical tools for solving immediate and pressing problems. The most efficacious strategy at the present time is to maximize the efficient use of currently available herbicides.

The response of water hyacinths to 2,4-D should be related to the amount of herbicide incorporated into plant tissues by processes such as sorption, and active transport. This herbicide is usually applied to water hyacinths in actual field situations by aerial spraying. It is unclear whether 2,4-D (DMA) is taken up primarily through the upper leaf surfaces from direct spray contact or via roots from the water after excess herbicide has dripped from the leaves into the water. Hildebrand (1946) and Hitchcock *et al*.

(1949) reported that the degree of control of E. crassipes by 2,4-D is greatly reduced by rainfall or wave action during the first three hours following spraying. Since these conditions would tend to wash 2,4-D from the leaf surfaces into the water, this suggests that the herbicide may function through leaf contact rather than via root uptake. Penfound and Minyard (1947) and Hitchcock et al. (1949) reported that 2,4-D is efficiently translocated from the leaves to other organs within a single individual plant of E. crassipes, but "very little" is transported through the connecting stolons to daughter rosettes with fairly well-developed roots. Ashton and Crafts (1981) indicate that chlorophenoxy herbicides display optimum concentration responses. Concentrations below the optimum provide too little toxicant to be effective at a distance from the treated foliage, while too much, produces excessive contact injury to the foliage resulting in little translocation. Although Sculthorpe (1967) reported that roots of E. crassipes may account for 20 to 50% of the plant's biomass depending on habitat and season, no mention was found of translocation of 2,4-D from roots to leaves of water hyacinth or the role of roots in uptake of 2,4-D from water.

Sculthorpe (1967) indicated that the angle of the leaves of E. crassipes relative to the water's surface is from 15^0 to 45^0 at the periphery and 75^0 to 90^0 in the center

of the rosette and is characteristic of the plant as a whole in crowded conditions. This steep inclination of the leaves would suggest that runoff of herbicide from the leaves into the water may be an important factor in control of water hyacinth with 2,4-D. Density of water hyacinth plants should affect the amount of herbicide interception from an aerial spray application and concurrently concentrations of 2,4-D in water and mass of herbicide on plant leaves. Therefore, plant population density may affect response (control) depending on whether aqueous or contact herbicide exposure is the most important source of chemical uptake. An understanding of the most effective route of exposure could lead to more efficient application techniques (e.g. aqueous application rather than aerial) and / or herbicide formulations (addition of adjuvants to retain the herbicide on water hyacinth leaves). Once these relationships have been defined, it should be possible to predict the response of water hyacinth populations to application "doses" (treatment concentrations) of 2,4-D under actual field situations by modeling the exposure route of water hyacinth to the herbicide and the environmental fate of the herbicide.

Computer Simulation Modeling

Methodologies are needed that will allow operational aquatic plant management personnel to optimally utilize available control techniques. A variety of site-specific and interacting environmental factors may strongly influence successful application of a control technique. Computer simulation models have proven useful in similar complex situations as decision support systems (Reinert and Rodgers 1987; Reinert et al. 1987).

Chemical control techniques, including herbicides such as 2,4-D, are used in a variety of aquatic environments. The physical, chemical and biological characteristics of these systems influence the herbicide's persistence and consequently the effectiveness of the herbicide as a control technique. The initial concentration of a herbicide introduced to an aquatic system is limited or regulated by its FIFRA registration label. Concentrations of herbicides in aquatic environments are not constant through time since they are affected by a number of processes. These processes are relatively well known and can be modeled by mass balance and kinetic approaches (Donigian 1982; Lassiter 1982). In particular, the fate processes controlling environmental concentrations of 2,4-D (DMA) are sorption to solids, Kp = 0.13 to 0.25, and biodegradation, 3.9 to 11 day half-life (Reinert and Rodgers, 1987). Other fate processes such as

volatilization, photolysis and hydrolysis are apparently insignificant transformation processes for this compound.

The responses of target aquatic plant populations to time-varying concentrations of herbicides are perhaps less well understood. Since the concentrations of herbicides in water are not constant through time and concentrations through time will vary under different environmental conditions, a descriptor of "exposure" other than initial concentration alone may be more useful as a predictor of population response. For the purposes of this research, "exposure" was defined as a function of concentration and time and was calculated as the area under the curve of plant tissue concentration of herbicide vs. time.

A computer simulation model was developed to allow an investigator to enter site specific characteristics pertaining to the environment to be simulated. The model generates estimates of target plant population (water hyacinth) response to an application of a herbicide [2,4-D (DMA)]. Using this simulation, herbicide application rates can be adjusted so optimal control can be obtained with the minimum amount of chemical and as an additional benefit, effects on non-target species may be minimized for the desired level of control. In development of the initial prototype model, water hyacinth and 2,4-D were selected since data are available on this aquatic weed species and

chemical (Gopal 1987). Although herbicide fate and target plant population response models are not currently available for aquatic systems, some parallel situations have been modeled for terrestrial systems (Brown et al. 1982).

One promising strategy that can lead to more efficient use of herbicides and concomitant cost savings is development of predictive models that can be used as a framework to guide operational activities. Using the computer simulation model as an investigative tool also allows examination of such strategies as treatment timing and repeated treatments. One of the purposes of this research was to obtain model calibration and validation data relating to herbicide fate and persistence, response of the target population (E. crassipes), importance of tissue concentration of 2,4-D, and regrowth of the population since appropriate data were not located in literature sources.

Research Objectives

In general, the objectives of this research were to enhance understanding of the concentrations of 2,4-D (DMA) required to achieve control of E. crassipes. The factors examined were the relationship between concentrations of 2,4-D in plant tissues, versus plant response (mortality) and the influence of route of plant exposure to 2,4-D. Since water hyacinth is an emergent species and the whole plant is

not in contact with the water, the route of herbicide exposure (roots vs. leaves) may play an important part in determining tissue concentration of 2,4-D and consequently, mortality. Degree of 2,4-D spray interception relative to plant density was investigated for the purpose of determining the relative amounts of 2,4-D available to plants from direct contact and aqueous sources. Finally, these data were used to calibrate and validate Modules I and II of the computer simulation model (developed during this research) estimating the fate and persistence of 2,4-D (DMA) in aquatic environments (Module I), response of water hyacinth to this exposure to 2,4-D (Module II), and subsequent water hyacinth population recovery (growth) following treatment (Module III).

Hypotheses

1) There is no relationship between concentration of 2,4-D (DMA) in tissues of E. crassipes and plant response (mortality).

   Corollaries:

   1) there is no lower bound (threshold, 0% response) to this relationship.

   2) there is no upper bound (response saturation, 100% mortality) to this relationship.

2) There is no relationship between 2,4-D (DMA) concentration in water and concentration of 2,4-D (DMA) in tissues of E. crassipes.
3) There is no relationship between contact time of 2,4-D (DMA) applied to the leaves of E. crassipes (contact via dipping in a 2 ppm solution for various durations) and concentration of the herbicide in plant tissues.
4) There is no relationship between concentration of 2,4-D (DMA) applied via aqueous exposure (root contact) to E. crassipes and concentration of the herbicide in plant tissues.
5) There is no relationship between density of E. crassipes and degree of aerial spray interception.
6) Computer simulation model predictions for these relationships are not significantly different from experimental observations.

CHAPTER II

MATERIALS AND METHODS

Microcosm Experimental Design

The herbicide formulation that was be used for these experiments was Weed-Rhap A-4D (Vertac). The maximum label application rate of this formulation is 5.25 liters/hectare and at 46.7% active ingredient, this approximates 2.45 liters/hectare of 2,4-D (DMA). The culture vessels used for these experiments are 1750 liter, cement tanks located at the UNT Water Research Field Station. Since the average depth of each tank is one meter and the surface area is 1.8 m^2, the label rate of application approximates 0.25 mg/l in containers of this volume. The overall experimental design is illustrated in Figure 2.

In the first experiment, water hyacinths were exposed to a 2 mg/l solution of 2,4-D (DMA) by dipping the above-water portions of the plants in the herbicide solution for varying contact times. The purpose of this experiment was to determine if leaf contact alone of water hyacinth to 2,4-D is sufficient to elicit mortality. Concentrations of 2,4-D were monitored in plant tissues periodically during the experiment. These data were used to establish the

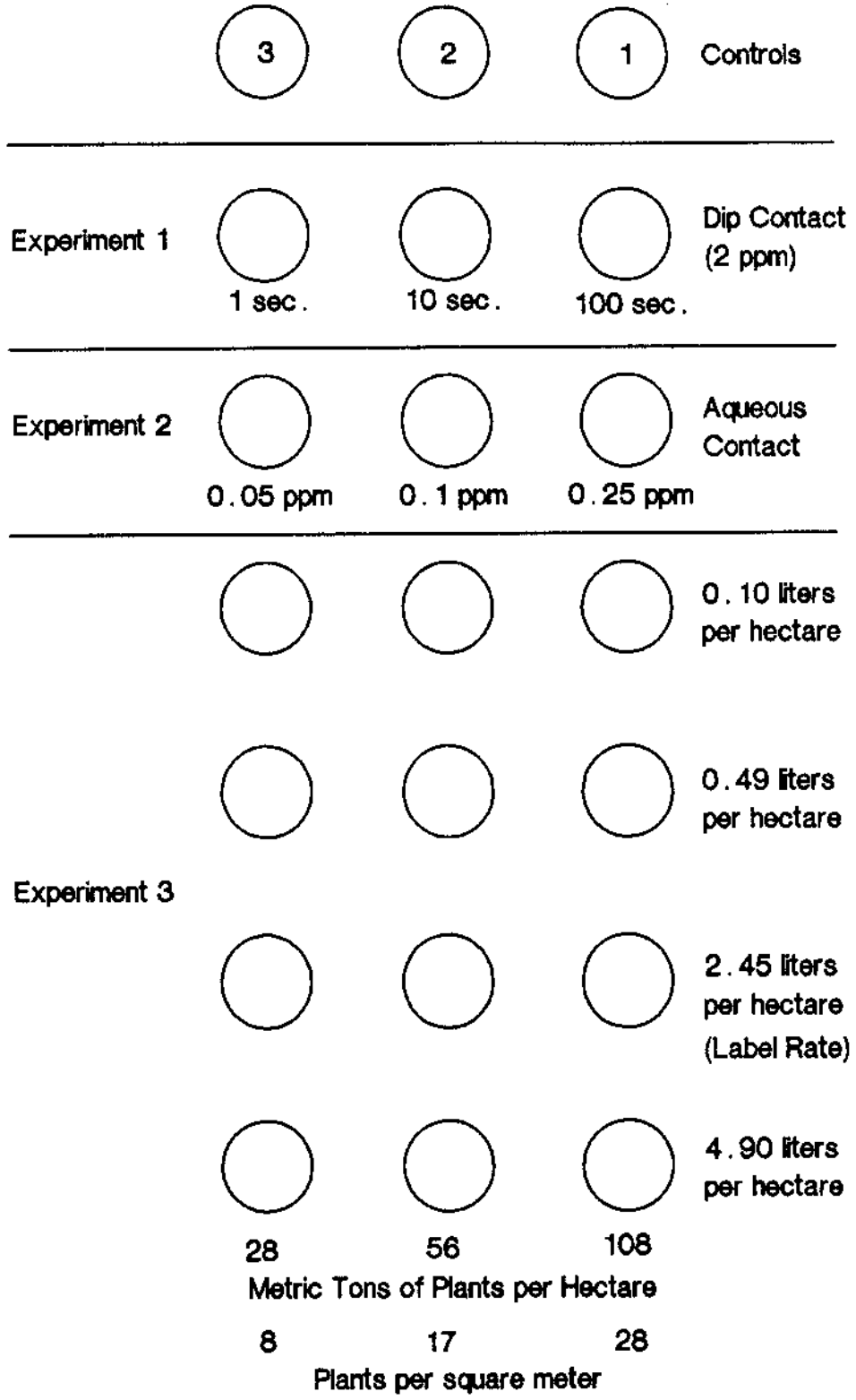

Figure 2. Experimental Design.

relationship between tissue concentration of 2,4-D obtained via leaf contact and mortality. The contact times were 1, 10 and 100 seconds. A contact solution concentration of 2 mg/l was selected because it provided sufficient 2,4-D in solution so that depletion of 2,4-D from the dipping solution via plant tissue uptake was not an important factor. The 2 mg/l solution approximates eight times label application rates for the formulation used also, 2 mg/l was selected as sufficiently in excess of the label application rate so that 1, 10 and 100 second contact times should describe the inflection points of the mortality response relationship (0%, partial, and 100% response).

In the second experiment, herbicide application was made via aqueous introduction to minimize contact of water hyacinth leaves with the herbicide. The purpose of this experiment was to determine if water hyacinth roots are capable of sufficient 2,4-D uptake to produce the tissue concentrations required to elicit a mortality response. The experiment was conducted at 0.05 mg/l, 0.1 mg/l, and 0.25 mg/l (maximum label application rate) to approximate concentrations expected to elicit a 0% mortality response, a partial mortality response, and full label application rates (100% mortality response) if roots are capable of 2,4-D uptake in sufficient quantities to elicit any response

across a range of environmentally realistic 2,4-D concentrations.

The third set of experiments was conducted to parameterize the relationships between water hyacinth tissue concentration of 2,4-D and mortality for different aerial spray "doses" and varying degrees of interception (plant population densities). Since population density affects the amount of herbicide that contacts the plants' leaves and the amount that enters the water and becomes available to the plants' roots, this experiment was conducted with several densities of water hyacinth and several concentrations of 2,4-D (DMA) applied via aerial spray. This experiment consisted of four "dose levels" of 2,4-D approximating 0.04, 0.2, 1.0, and 2.0 times label application rates (0.10 liters / hectare, 0.49 liters / hectare, 2.45 liters / hectare, and 4.90 liters / hectare) and three densities of water hyacinth at each concentration. The densities of water hyacinth that were used in this experiment were 8, 17, and 28 plants / m^2 (approximating 28, 56, and 108 metric tons / hectare). Herbicide (2,4-D) was applied with a spray applicator and water hyacinth biomass was determined through time by periodically removing and weighing three representative plants from each container and multiplying the mean weight by the number of plants in the container to estimate total biomass. Subjective estimates of mortality were also made by

visual comparison of treatments to controls (Langland, et al., 1983). Herbicide (2,4-D) concentrations in water, plant tissue, and sediments were determined through time using procedures described in Appendix A. The analytical method for 2,4-D (DMA) involves derivatization of the 2,4-D to the methyl-ester using a procedure adapted from Knapp (1979). The derivative was extracted with hexane and analyzed using gas-liquid chromatography and an electron-capture detector (Moses 1985). The product of this experiment is a translation step of the information gathered in the first two sets of experiments to actual field situations.

Since water hyacinth tissue concentrations of 2,4-D based on exposure concentration and route of exposure were demonstrated in the first and second sets of experiments and the third set of experiments parameterized the relationship between plant density and exposure concentrations via water and leaf contact with aerial herbicide application, actual field situations can be modeled.

These data were used to calibrate the coupled herbicide fate and target plant population effects computer simulation model developed in 1988 (Clifford and Rodgers, 1989).

Field Validation Study

Model validation was performed by comparing model predictions with experimental observations obtained from a

field operation conducted at Wallisville, Texas. The field operation consisted of treating a 0.37 hectare plot of water hyacinths with the maximum label application rate of Weedar 64 (Union Carbide). This application rate is 4.26 kg active ingredient per hectare (9.35 liters per hectare of formulation).

Water and plant samples were collected periodically during the study from randomly selected locations within the treatment area. Nine, one-liter water samples were collected on each sampling date, preserved with H_2SO_4, and stored for later analysis. Each plant sample was obtained by removing all of the plant matter from 0.25 m^2 area. The plants were rinsed to remove water soluble 2,4-D from the surface. The total volume of the rinsate was measured and one liter was preserved in the same manner as the water samples. The total weight of plants in each sample was determined and the plants were sub-divided into leaves, stems (rhizomes and stolons), and roots. The weights of each sub-sample were recorded and the samples were frozen for later analyses. The purpose of this plant sample sub-division was to monitor translocation of 2,4-D within the plants through time.

These experiments were performed by the U. S. Army Corps of Engineers (Waterways Experiment Station) personnel and the plant and water samples were sent to UNT for 2,4-D residue analysis. Similar sampling regimes were established

for both the experiments conducted at the UNT Water Research Field Station and those conducted at Wallisville, Texas. Since the sampling regimes were coordinated and 2,4-D residue analyses were performed in the same laboratory, the data obtained were sufficiently complementary to provide a complete calibration and validation of the computer simulation model.

The Computer Simulation Model

The model was written in Quick-BASIC^{tm} 3.00 (copyright Microsoft Corporation, 1987) for use with most IBM and IBM-compatible computers. The hardware requirements are: dual floppy disk drives or hard disk drive, color monitor, and optional 80 column dot-matrix printer. The model consists of a series of essentially stand-alone sub-routines which are linked together by common variables and data.

CHAPTER III

RESULTS AND DISCUSSION

Microcosm Studies

No water hyacinth mortality was observed in experiments in which plants were dipped in a 2 ppm solution of 2,4-D for varying contact times of 1, 10, and 100 seconds. Analysis of the contact solution verified that the concentration was approximately 2 ppm. The maximum observed 2,4-D concentrations in plant tissues occurred on day seven at a concentration of 0.19 mg/kg plant wet weight. These data are presented in Figure 3. Water concentrations of 2,4-D were below detection limit (approximately 25 ppb) except on day seven when a concentration of 0.05 ppm was observed. Sediment concentrations of 2,4-D were below detection limit except on day zero at a maximum concentration of 0.08 mg/kg sediment wet weight. The results from this study suggest that leaf-contact of 2,4-D even at concentrations approximating eight times label application rate (estimated water concentration with no interception) is insufficient to produce tissue concentrations sufficient to elicit mortality. In actual field situations, at tank-mix dilutions of 1:130 (formulation:water, label recommendation) the concentrations of 2,4-D contacting leaf surfaces

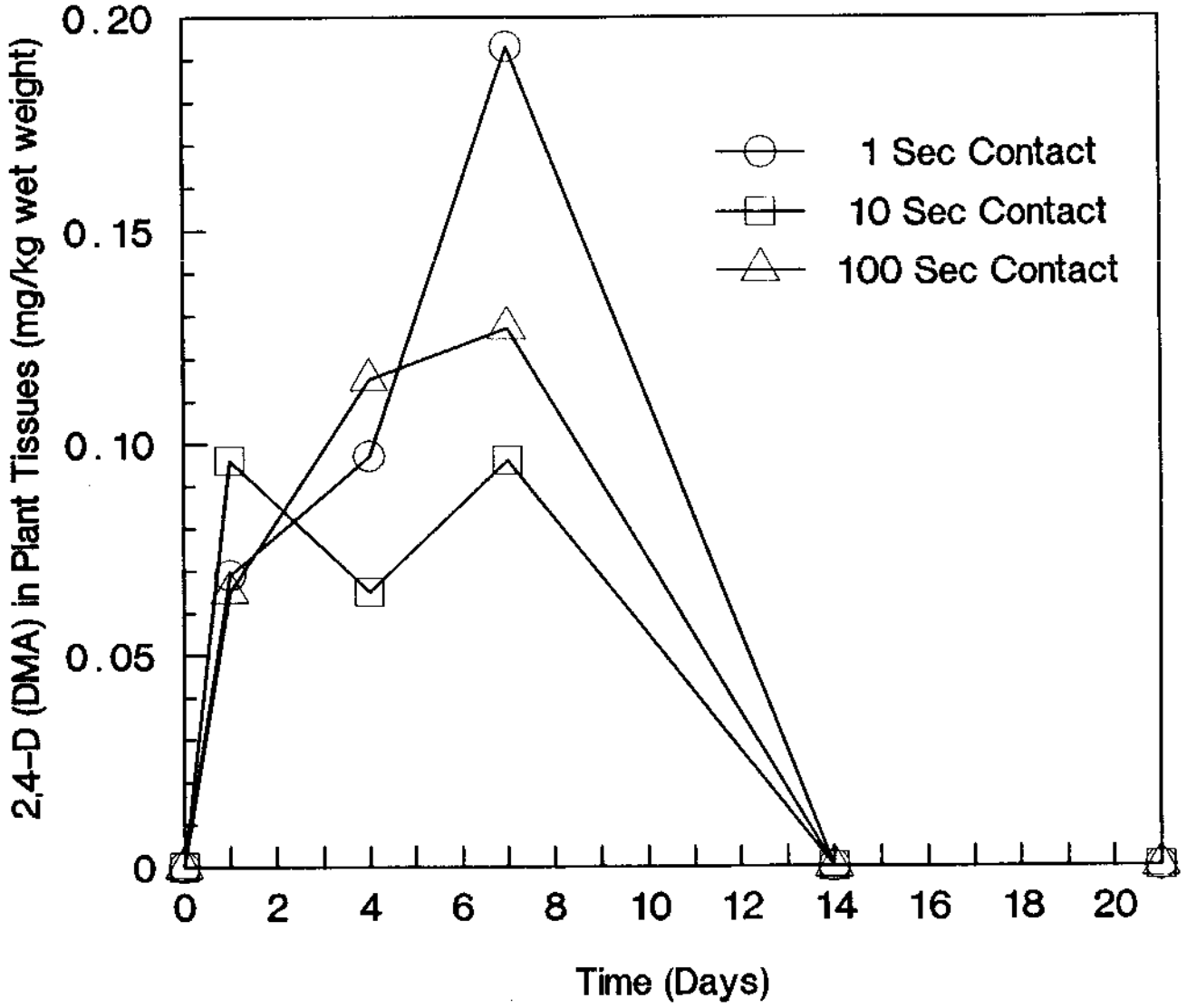

Figure 3. 2,4-D Concentrations Observed in Plant Tissues During the Leaf-Contact Experiment.

approximates 3,600 mg/l. This suggests that plants that are not directly contacted by a concentrated herbicide spray will probably not receive sufficient 2,4-D through the leaves from water which has been contacted by the spray to elicit mortality.

The second experiment was designed to determine if water hyacinth is capable of uptake of sufficient quantities of 2,4-D through roots from water which has been contacted by herbicide spray to elicit mortality. The maximum water hyacinth tissue concentration of 2,4-D observed in this experiment occurred on day seven. This concentration was 0.3 mg/kg wet weight (Figure 4). No mortality was observed in this experiment. Actual aqueous concentrations are presented in Figure 5. Measured water concentrations in this experiment were lower than the targeted concentrations. This was probably due to incomplete mixing of the herbicide with water prior to addition of plants. Maximum sediment concentrations of 2,4-D were observed on day zero in the highest exposure concentration (0.25 ppm target) at 0.24 mg/kg sediment wet weight and no 2,4-D was observed in subsequent sediment samples. The results of this experiment suggest that water hyacinths are not capable of uptake of sufficient quantities of 2,4-D through the roots from water even at maximum label application rates to elicit a mortality response.

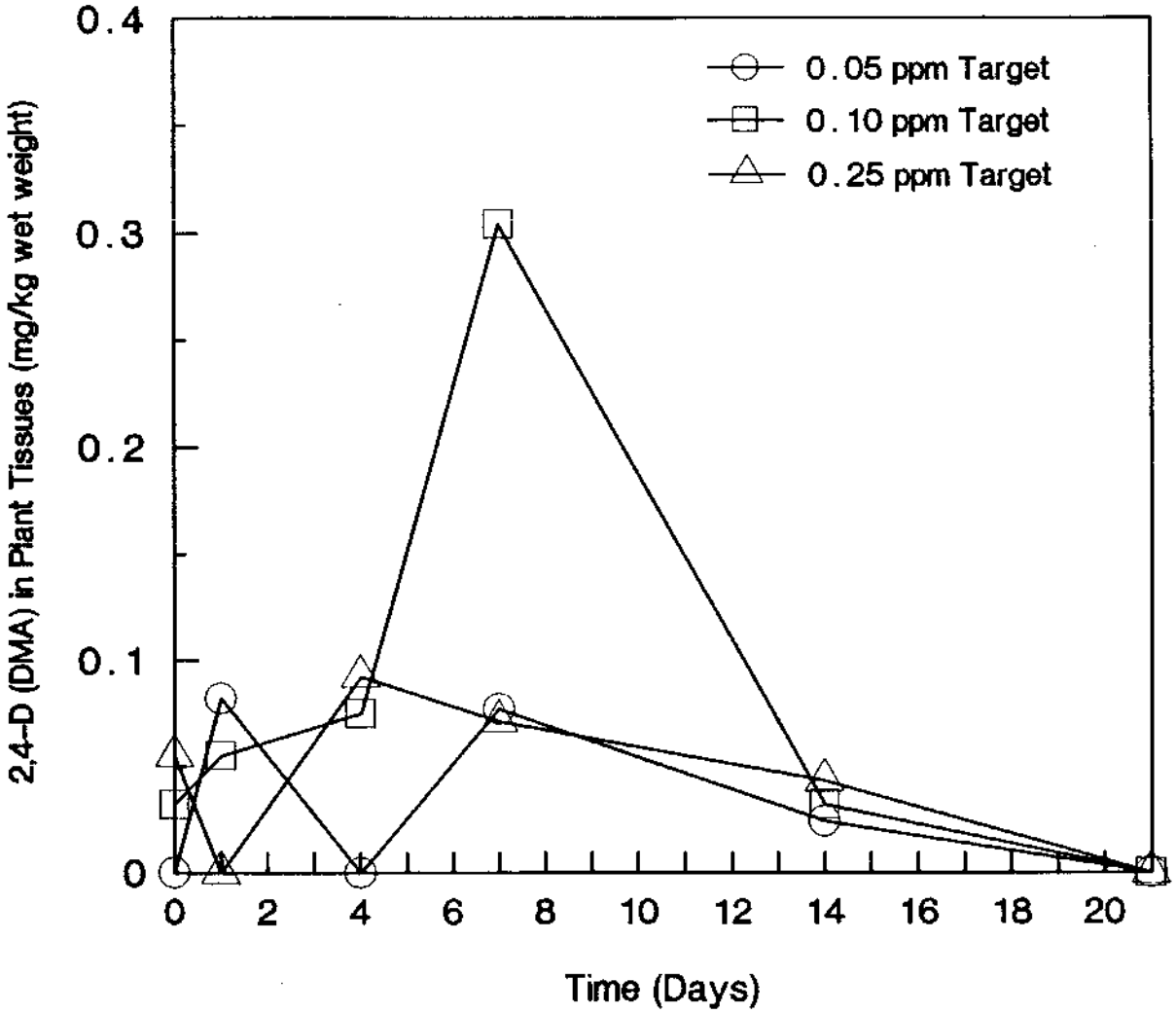

Figure 4. 2,4-D Concentrations in Plant Tissues (water hyacinth) During the Aqueous Exposure Experiment.

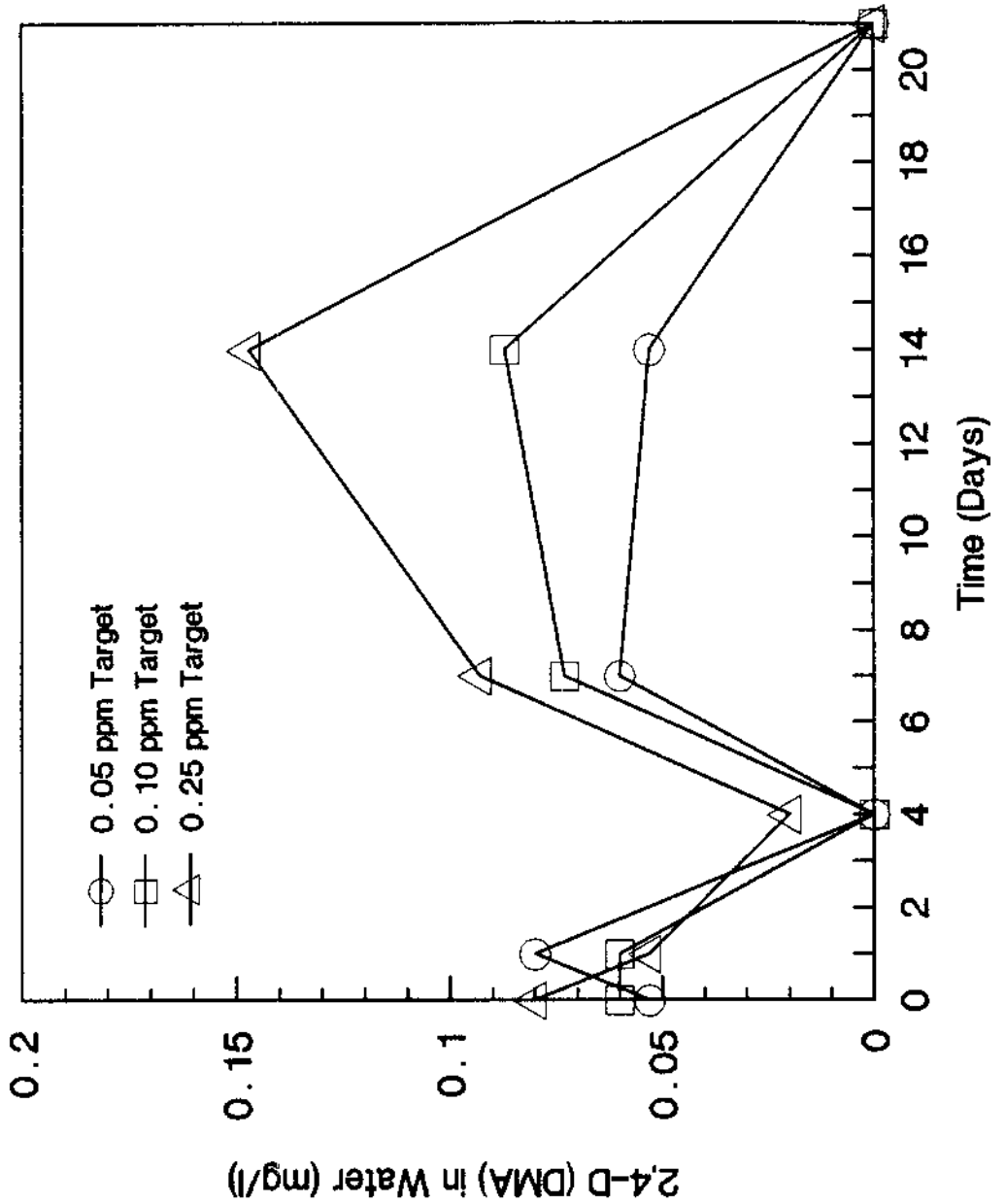

Figure 5. 2,4-D Concentrations in Water During the Aqueous Exposure Experiment.

Experiments one and two suggest that the primary route of 2,4-D uptake by water hyacinths is via contact of concentrated spray with the emergent portions of the plants. It appears that 2,4-D uptake by water hyacinth from water via contact with roots or emergent portions of the plants even at maximum label application rates plays an insignificant role in the effectiveness of 2,4-D as a control agent for water hyacinths.

Experiment three was designed to parameterize the exposure-response relationship of water hyacinth to 2,4-D and to determine the effects of density on interception of 2,4-D by plants when herbicide application is made via aerial spray. The concentrations of 2,4-D in water hyacinth tissues and in water during this experiment are presented in Figures 6 and 7. Figure 8 illustrates change in mean plant biomass through time in these experiments. Biomass was not observed to be a good predictor of mortality. This is probably because a large fraction of the plant's biomass is present in the roots and the decay of roots and submerged portions of the dead leaves proceeded very slowly. The results from visual estimates of mortality are presented in Figures 9 and 10. This exposure-mortality relationship indicates that the critical tissue concentration of 2,4-D in tissues of water hyacinth required to elicit a maximum mortality response occurs at approximately 12 mg 2,4-D per

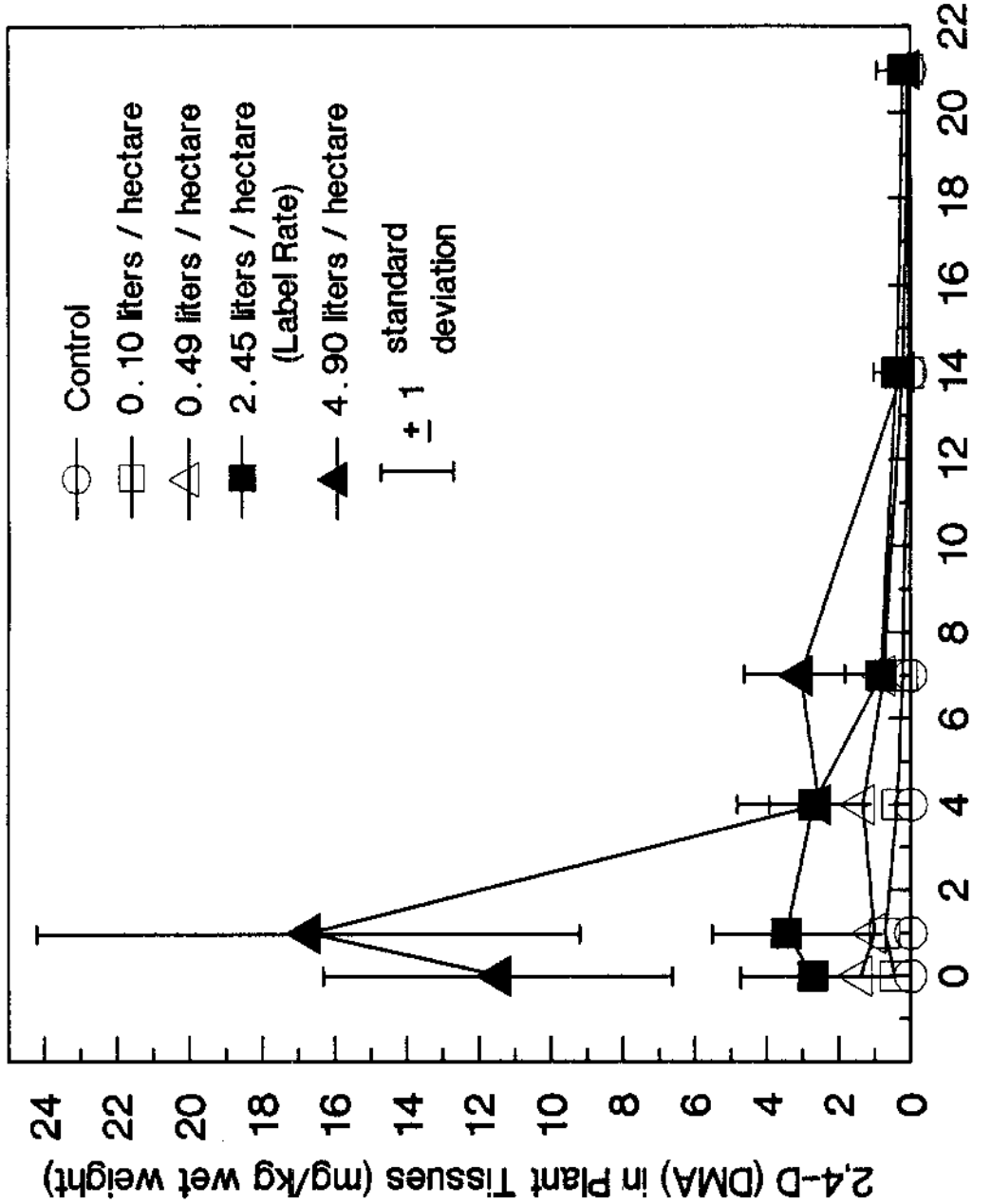

Figure 6. 2,4-D Concentrations in Plant Tissues (water hyacinth) During the Spray Exposure Experiments.

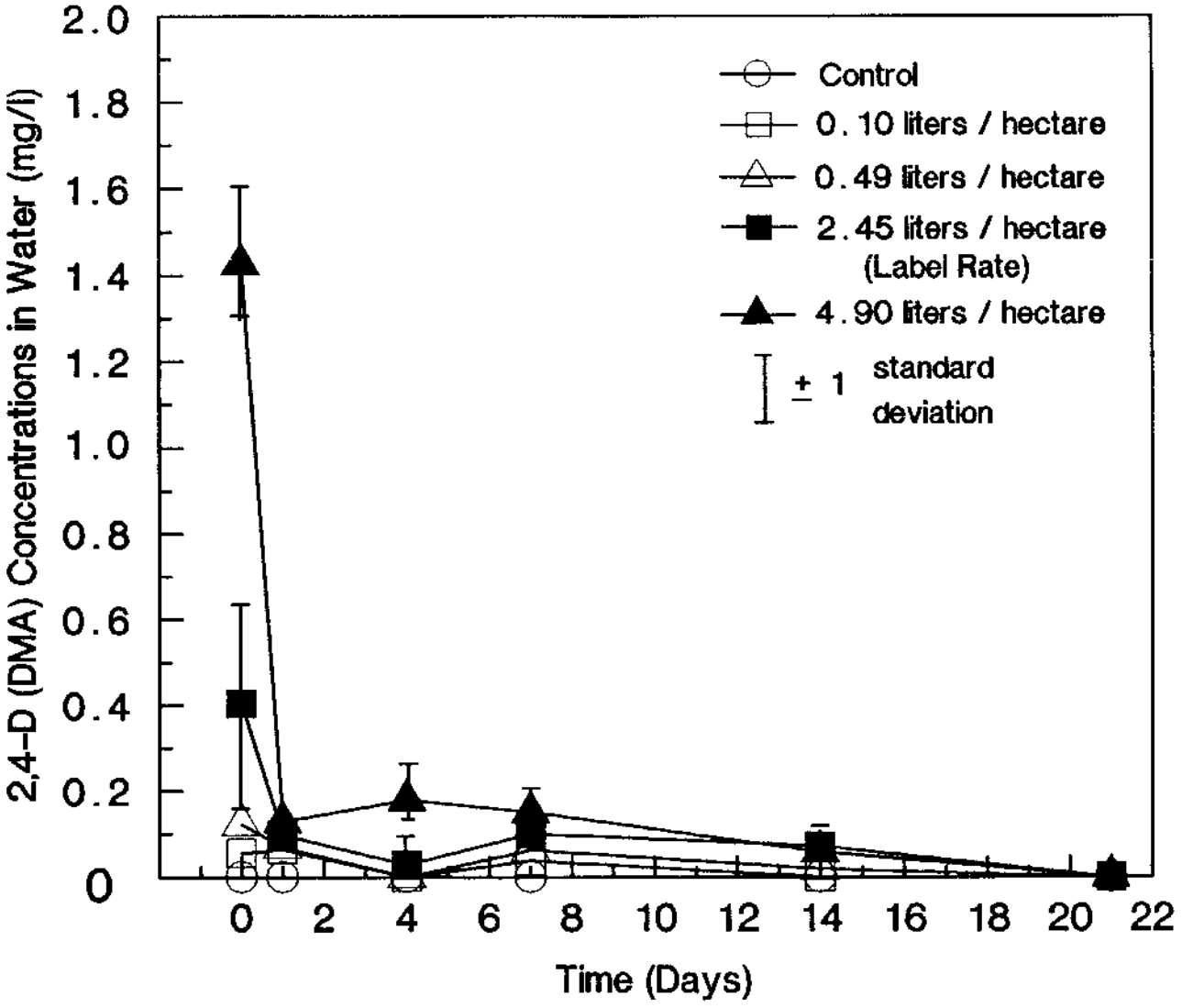

Figure 7. 2,4-D Concentrations in Water During the Spray Exposure Experiments.

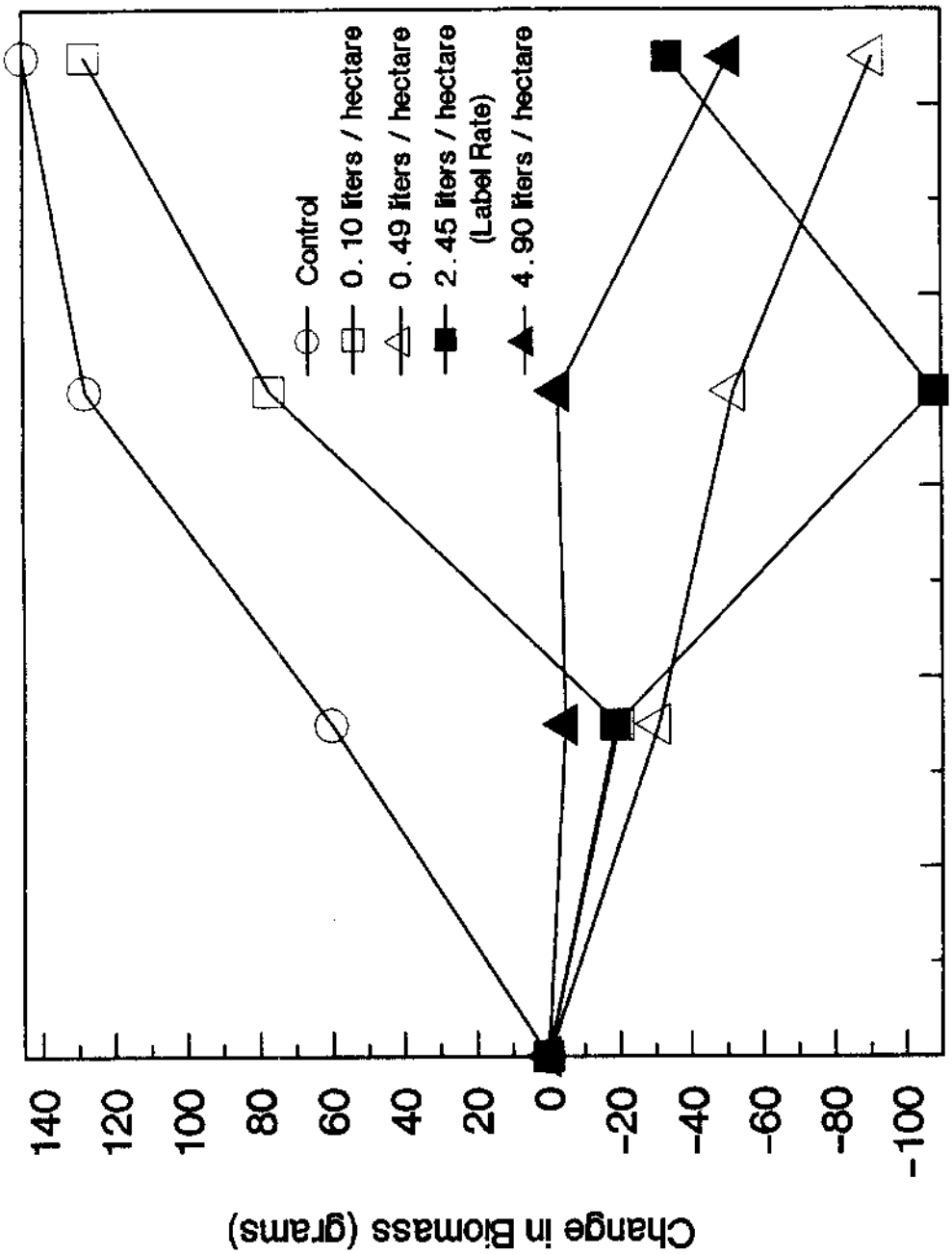

Figure 8. Change in Mean Biomass Observed During the Spray Exposure Experiments.

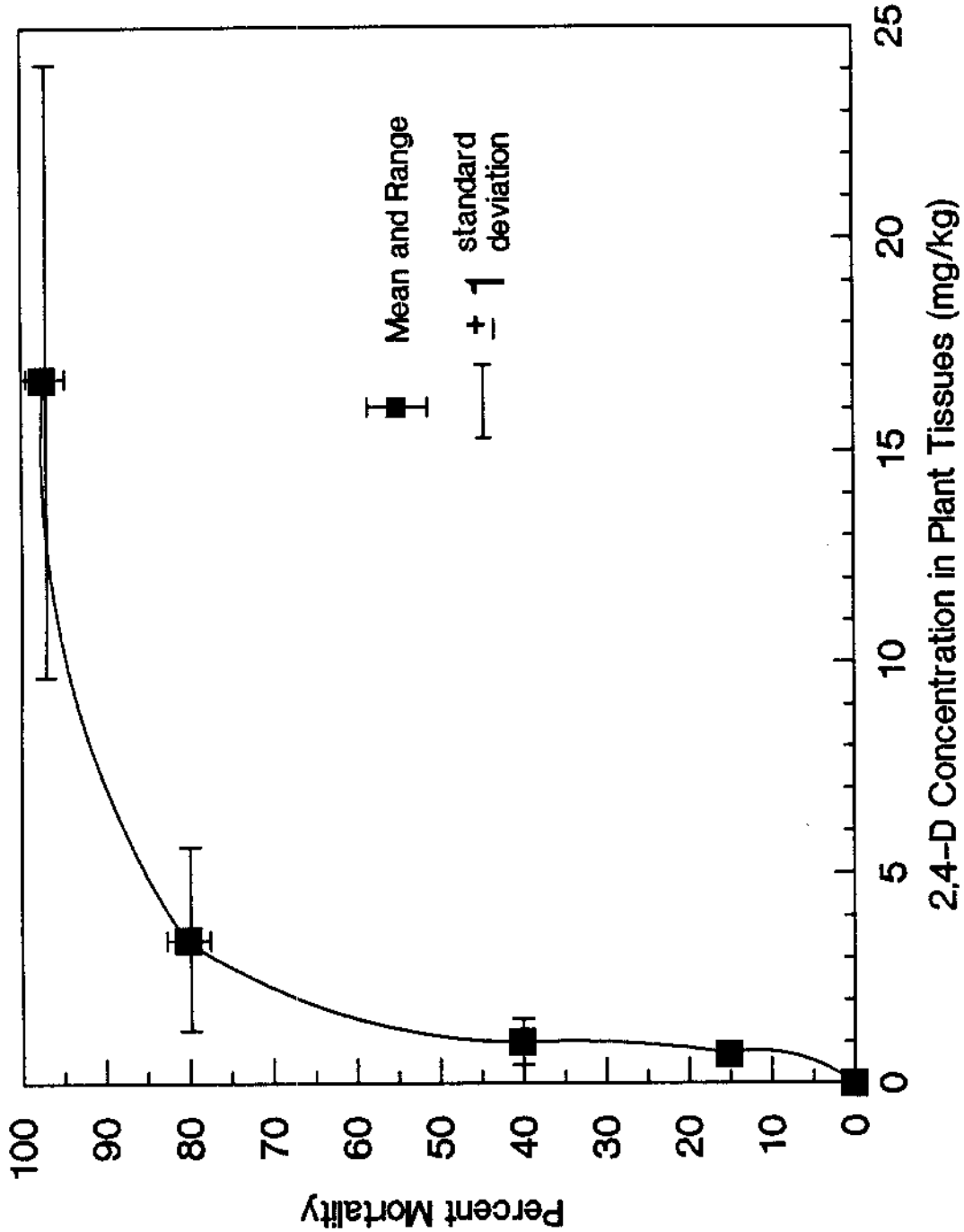

Figure 9. Visually Estimated Mortality Observed During the Spray Exposure Experiments.

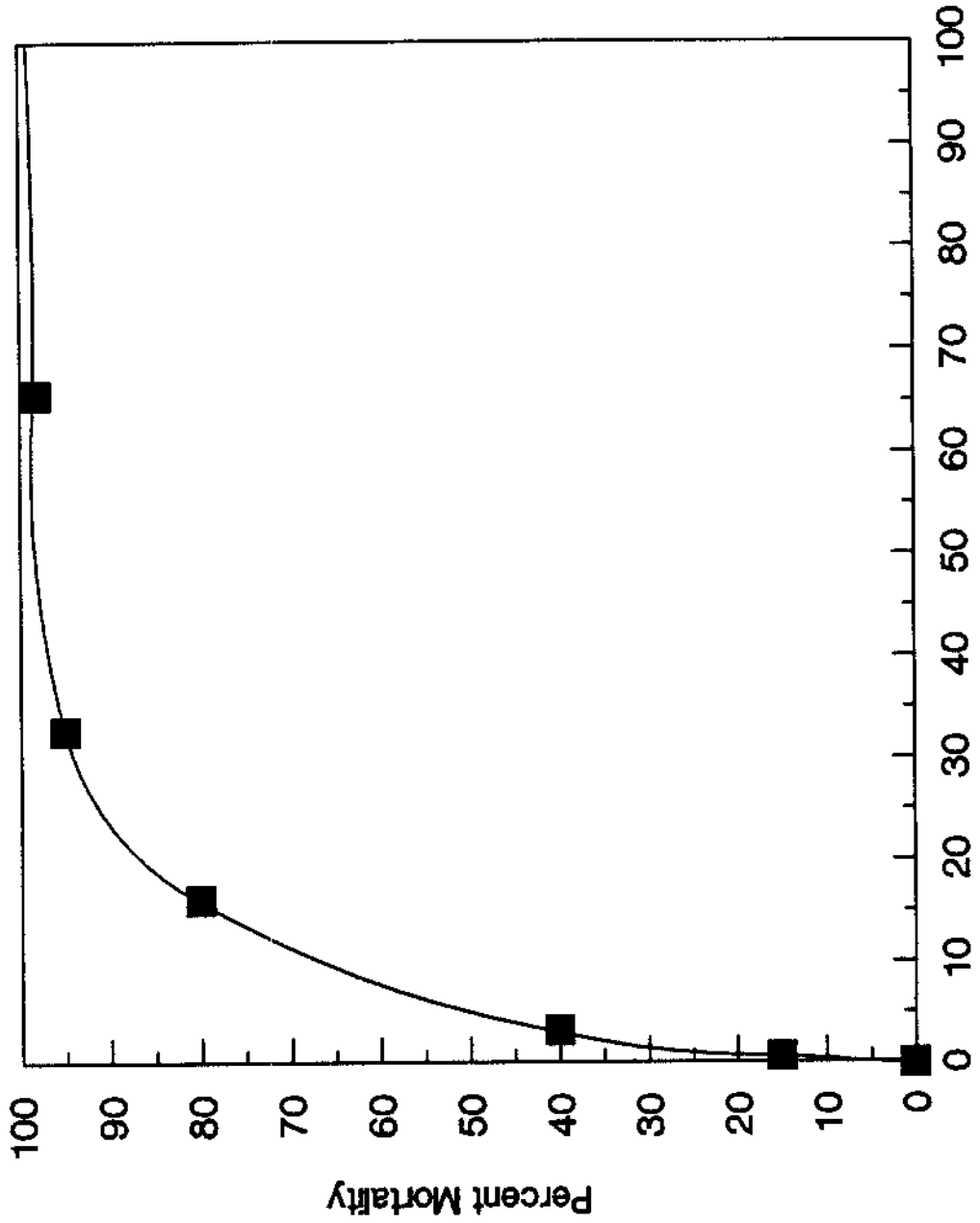

Figure 10. Percent Mortality vs. Exposure (mg/kg-days).

kg plant tissue wet weight. This and the overall shape of this curve are some of the factors required for calibration of the computer simulation model. One-hundred percent mortality was not observed during this experiment even at double label application rates of 2,4-D. This appears to have been due to 2,4-D interception by mature plants thereby protecting daughter ramets from sufficient spray exposure to elicit a mortality response. This upper mortality bound of approximately 98% is another factor required for computer simulation model calibration.

The halflife of 2,4-D estimated across all of these experiments was approximately 2.5 days. This value is probably somewhat inflated due to the fact that water samples were collected from the plant root zone (2-5 cm below the water surface) and mixing of the 2,4-D with the water in the tanks immediately following spray application was probably not complete at this time.

The relationship between plant density and degree of 2,4-D spray interception is essentially linear ($r^2 = 0.998$) and follows the equation:

$$\% \text{ interception} = (0.191 * \text{mass}) + 0.417$$

where mass is weight of plants in metric tons per hectare. This relationship was determined by estimating the plant biomass present in each tank (mean measured weight per plant times number of plants in each tank), extrapolating the mass

of 2,4-D present in plant tissues (2,4-D concentration times mass of plants), and calculating the percent of 2,4-D present in plant tissues relative to the mass that was applied. Water concentrations of 2,4-D were not used for these calculations because incomplete mixing of this compartment would tend to bias estimates. Only data for day one and label application rate were used in this calculation.

Percent dry weight of plant tissue and sediments were determined by drying for 24 hours at 104 °C. Plant tissue dry weight percent was determined to be 7.84% ± 4.96 (mean and standard deviation, N = 41). Sediment dry weight percent was determined to be 75.82% ± 3.27 (N = 77). These values are also required for model simulation and were used in the comparisons of model simulations with experimental observation.

Table 1 lists the data used for comparison of computer model simulations with experimental observations. Figures 11 - 13 illustrate these comparisons. Although the computer simulation produced results comparable with observations for plant tissue and water compartments, sediment concentrations of 2,4-D were over predicted. This may have been due to incomplete mixing of the water compartment.

Table I. Data used for microcosm simulations. The values listed here are those used in the simulations illustrated in Figures 11 - 13. The symbol '*' in indicates that process is insignificant for the compound.

Parameter	Value	Reference
Average Depth of area to be Treated (meters)	1.0	This study
Water Flow Rate From Treated Area (meters/min.)	0.0	This study
Total Suspended Solids in Water (mg/l)	4.0	Clifford, et al. 1988
Depth of Active Sediment Layer (cm)	0.2	Clifford, et al. 1988
Sediment Water Content (%)	24.2	Clifford, et al. 1988
Sediment/Herbicide Diffusion Exchange Rate (cm/day)	0.36	Reinert and Rodgers,1986
Sedimentation Rate (cm/Year)	0.40	Clifford, et al. 1988
Sediment Resuspension Rate (cm/Year)	0.20	Clifford, et al. 1988
Active Ingredient Fraction of Herbicide (kg/l)	0.451	Herbicide label
Application Rate of Formulation (liters/hectare)	5.266	Herbicide label
Loss of Herbicide Due to Drift (%)	0.00	--
Herbicide Sediment Layer Partition Coefficient (Kp)	0.25	Reinert and Rodgers,1987
Herbicide Hydrolysis Halflife in Water (days)	*	Reinert and Rodgers,1987
Herbicide Hydrolysis Halflife in Sediment (days)	*	Reinert and Rodgers,1987
Herbicide Oxidation Halflife in Water (days)	*	Reinert and Rodgers,1987
Herbicide Oxidation Halflife in Sediment (days)	*	Reinert and Rodgers,1987
Herbicide Biotransformation Halflife in Water (days)	2.5	This study
Herbicide Biotransformation Halflife in Sediment (days)	2.5	This study
Herbicide Photolysis Halflife in Water (days)	*	Reinert and Rodgers,1987
Herbicide Volatilization Halflife in Water (days)	*	Reinert and Rodgers,1987
Percent Interception at This Plant Density	21.1	This study
Plant Biomass to be Treated (metric tons/hectare)	108.4	This study
Percent Dry Weight of Plant Tissue	7.84	This study

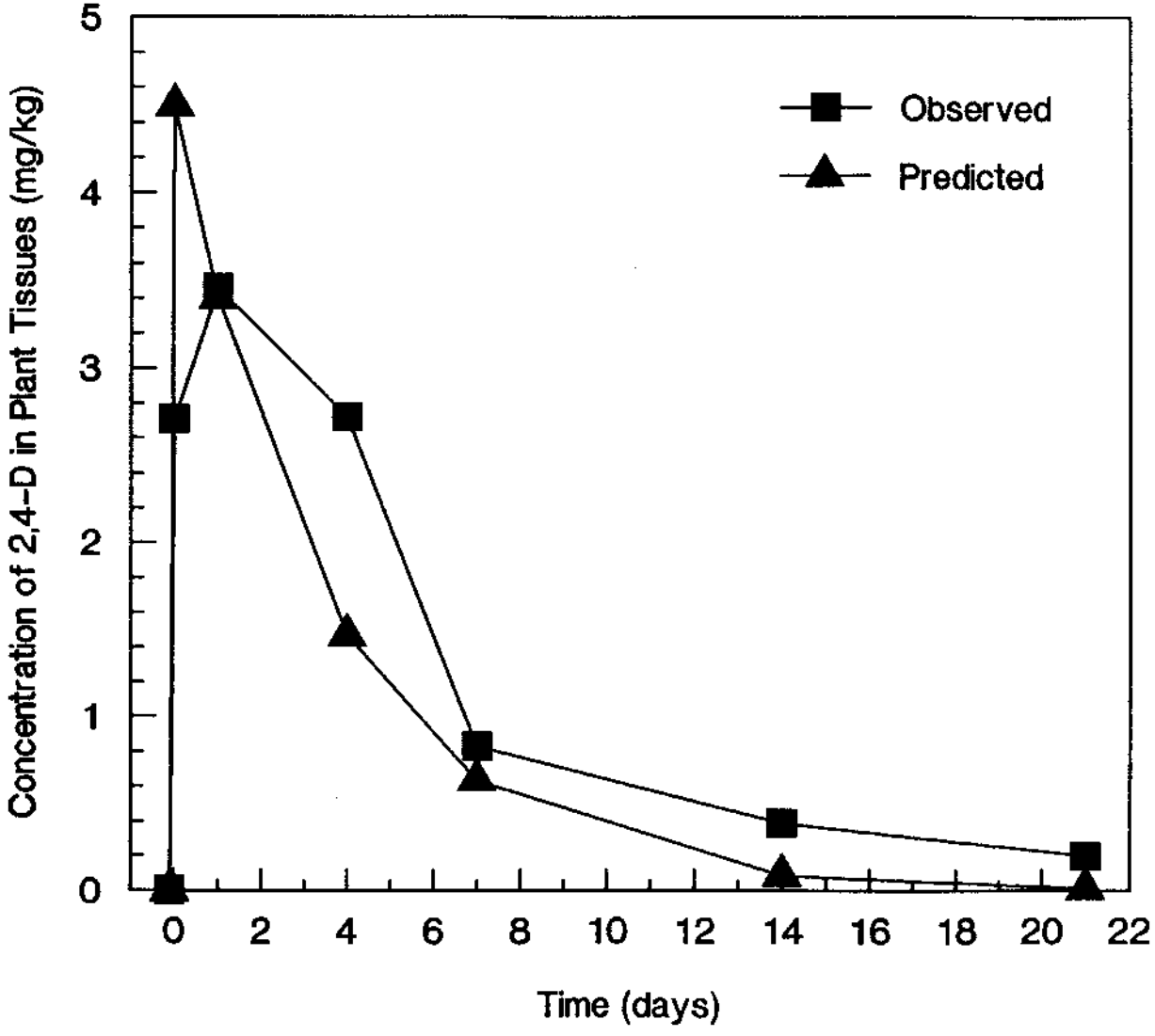

Figure 11. Comparison of Computer Simulation Model Predictions with Microcosm Study Observations for 2,4-D in Tissues of Water Hyacinth. Simulations Were Conducted for Maximum Label Application Rate of 2,4-D and 108.4 Metric Tons of Water Hyacinth Per Hectare.

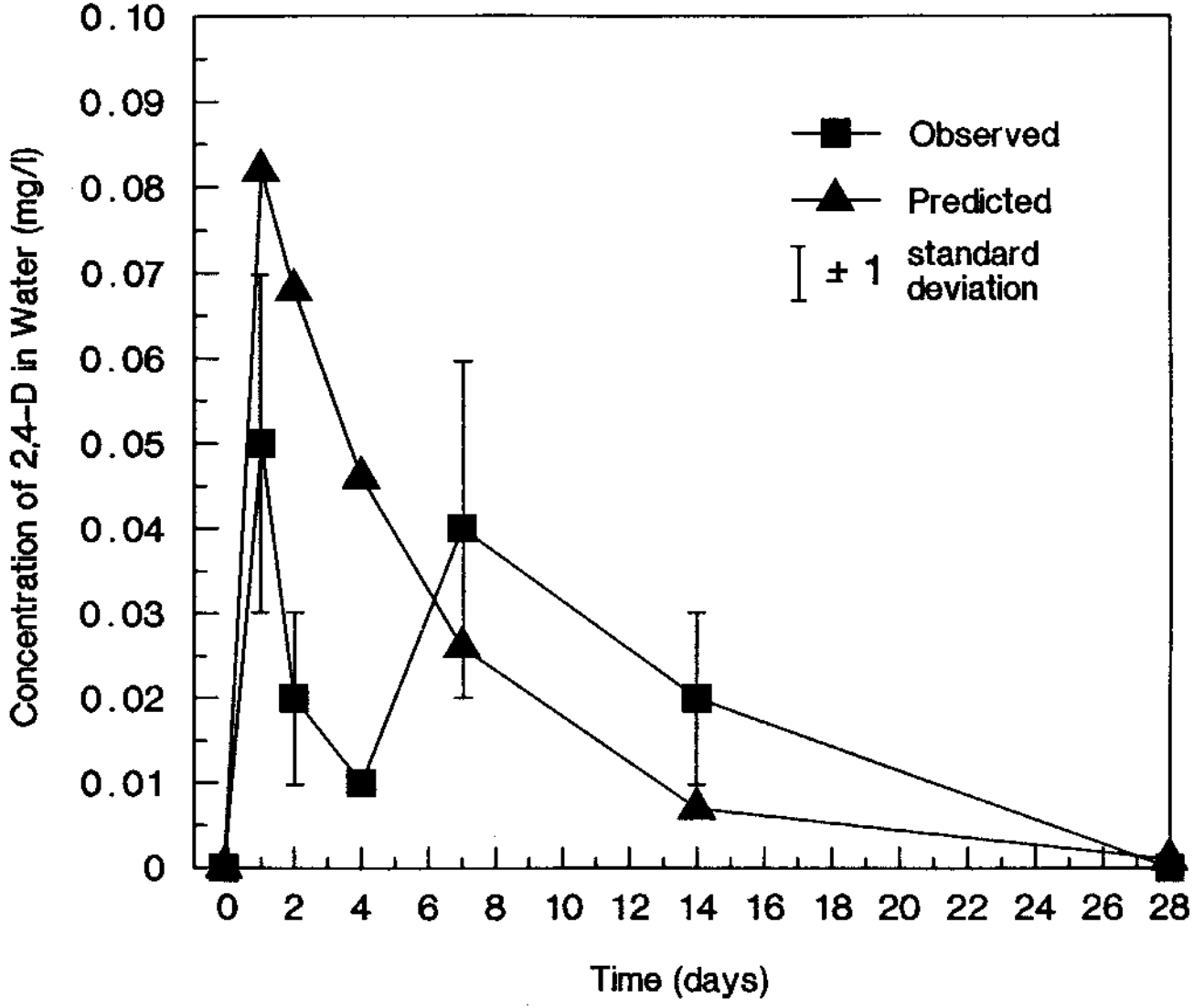

Figure 12. Comparison of Computer Simulation Model Predictions with Microcosm study Observations for 2,4-D in Water. Simulations Were Conducted for Maximum Label Application Rate of 2,4-D and 108.4 Metric Tons of Water Hyacinth Per Hectare.

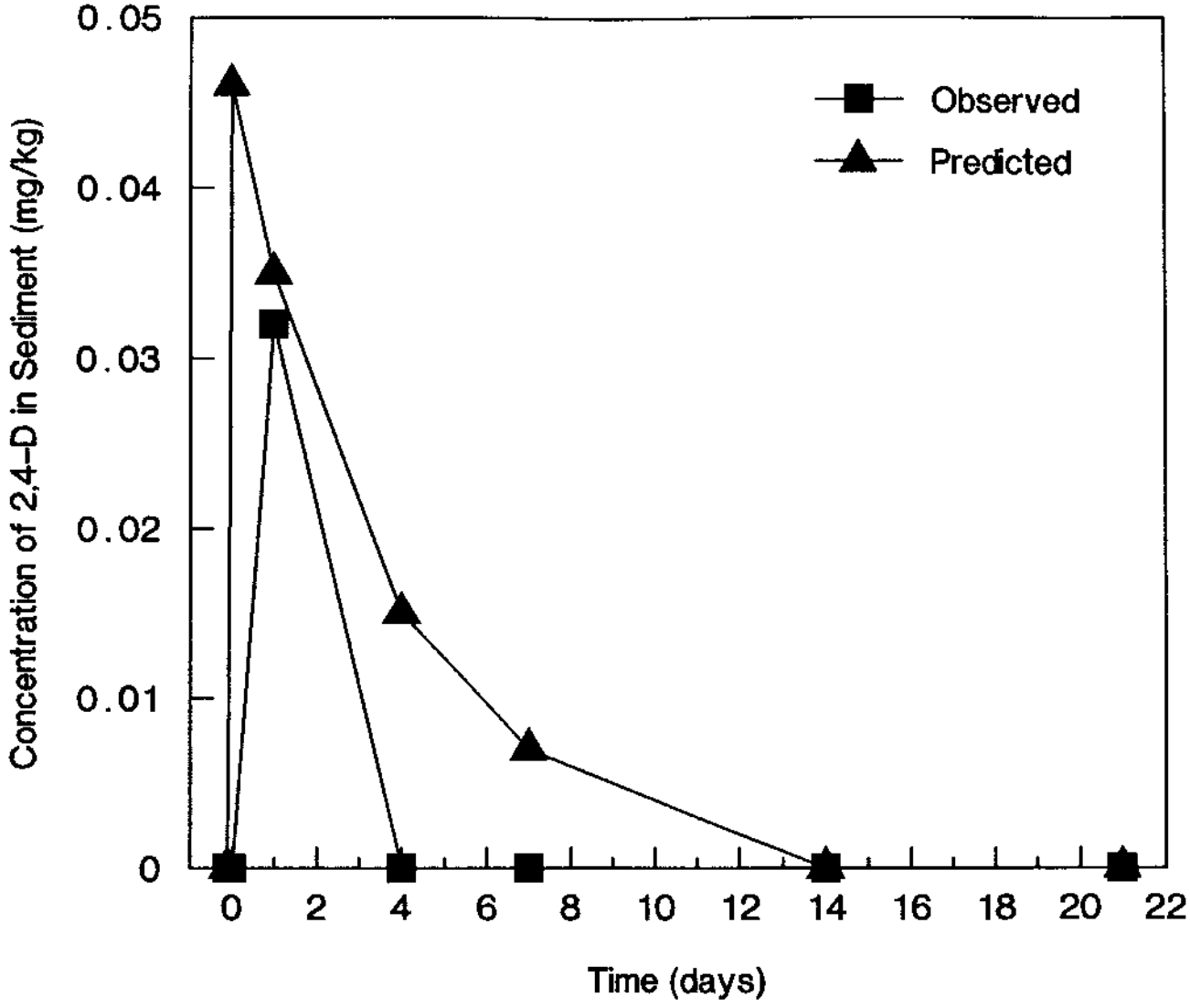

Figure 13. Comparison of Computer Simulation Model Predictions with Microcosm Study Observations for 2,4-D in Sediments. Simulations Were Conducted for Maximum Label Application Rate of 2,4-D and 108.4 Metric Tons of Water Hyacinth Per Hectare.

Field Validation Study

Translocation of 2,4-D into stems (rhizomes and stolons) of water hyacinth was observed in the Wallisville field validation study. The mean measured 2,4-D concentration in water hyacinth stems on day one was 0.30 mg 2,4-D per kg plant tissue wet weight. This value increased to a mean maximum of 0.64 mg/kg on day seven and declined during the rest of the study (Figure 14). These observations support Penfound and Minyard (1947) and Hitchcock et al. (1949) who report that 2,4-D is efficiently translocated from the leaves to other organs within a single individual plant of water hyacinth, but very little is transported through the connecting stolons. Concentrations of 2,4-D in roots of water hyacinth were relatively constant through time. These data are presented in Figure 15.

Figure 16 illustrates the mass of 2,4-D which was removed from plants by rinsing with water. The maximum mass of 2,4-D which was removed was 0.17 mg 2,4-D per kg plant tissue wet weight (day 1). Since this mass is only a fraction of plant tissue concentrations at the same sampling time (7.17 mg / kg) it appears that the majority of the 2,4-D had either penetrated plant tissues or been converted to the relatively water insoluble acid form.

As observed in the microcosm studies, biomass measurements in the field validation study were poor

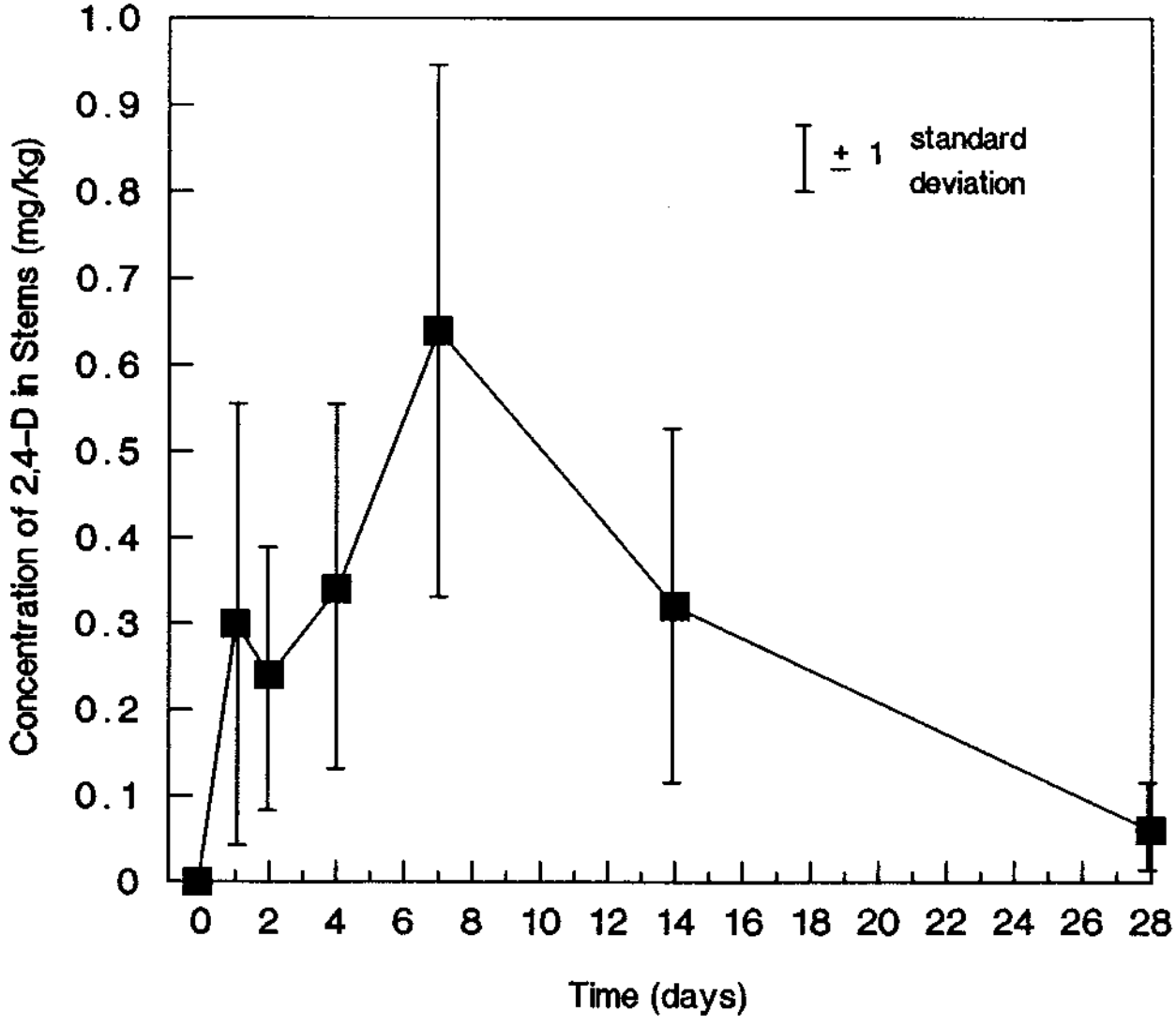

Figure 14. 2,4-D Concentrations in Water Hyacinth Stems (Stolons and Rhizomes) During the Field Validation Study.

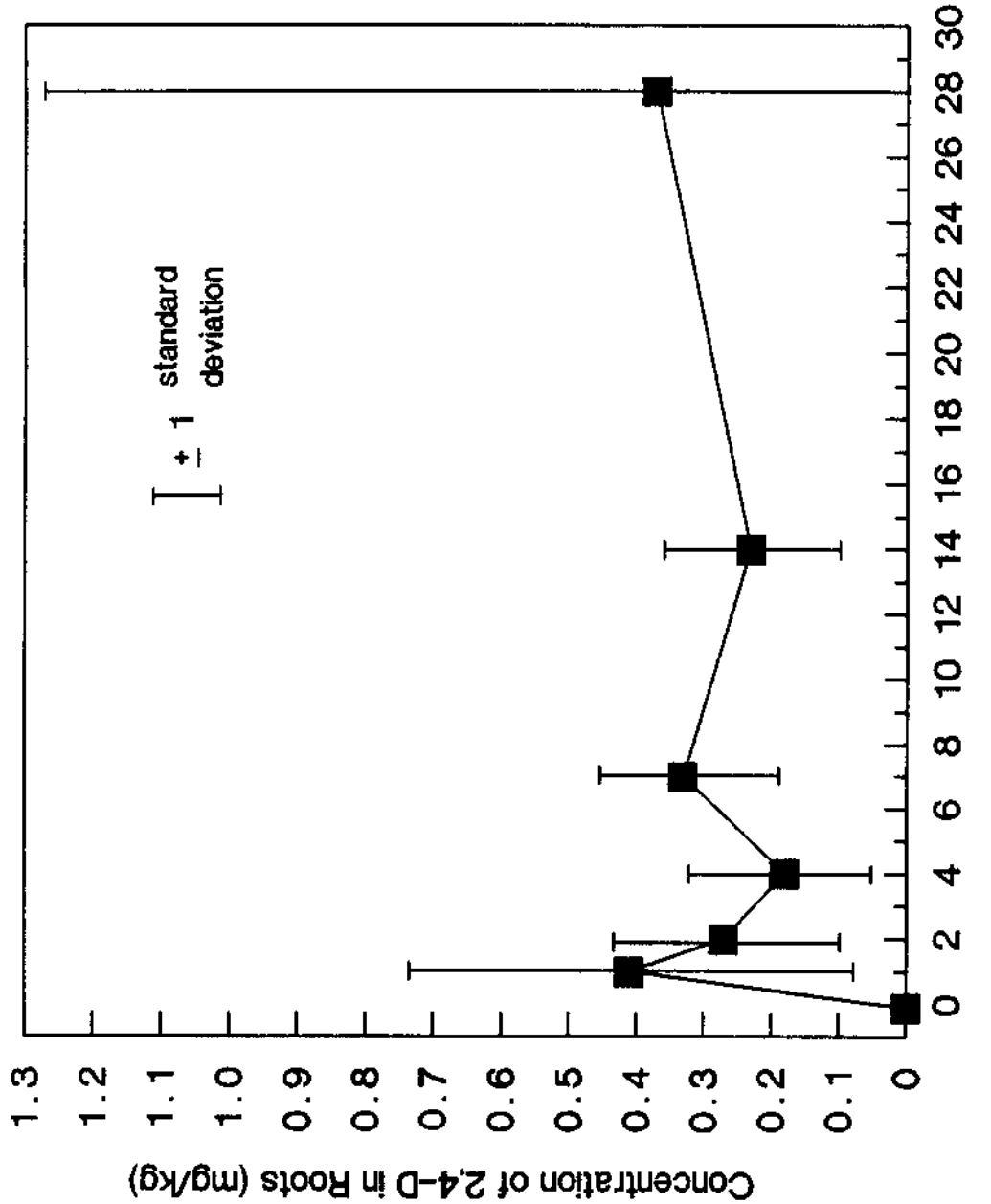

Figure 15. 2,4-D Concentrations in Water Hyacinth Roots During the Field Validation Study.

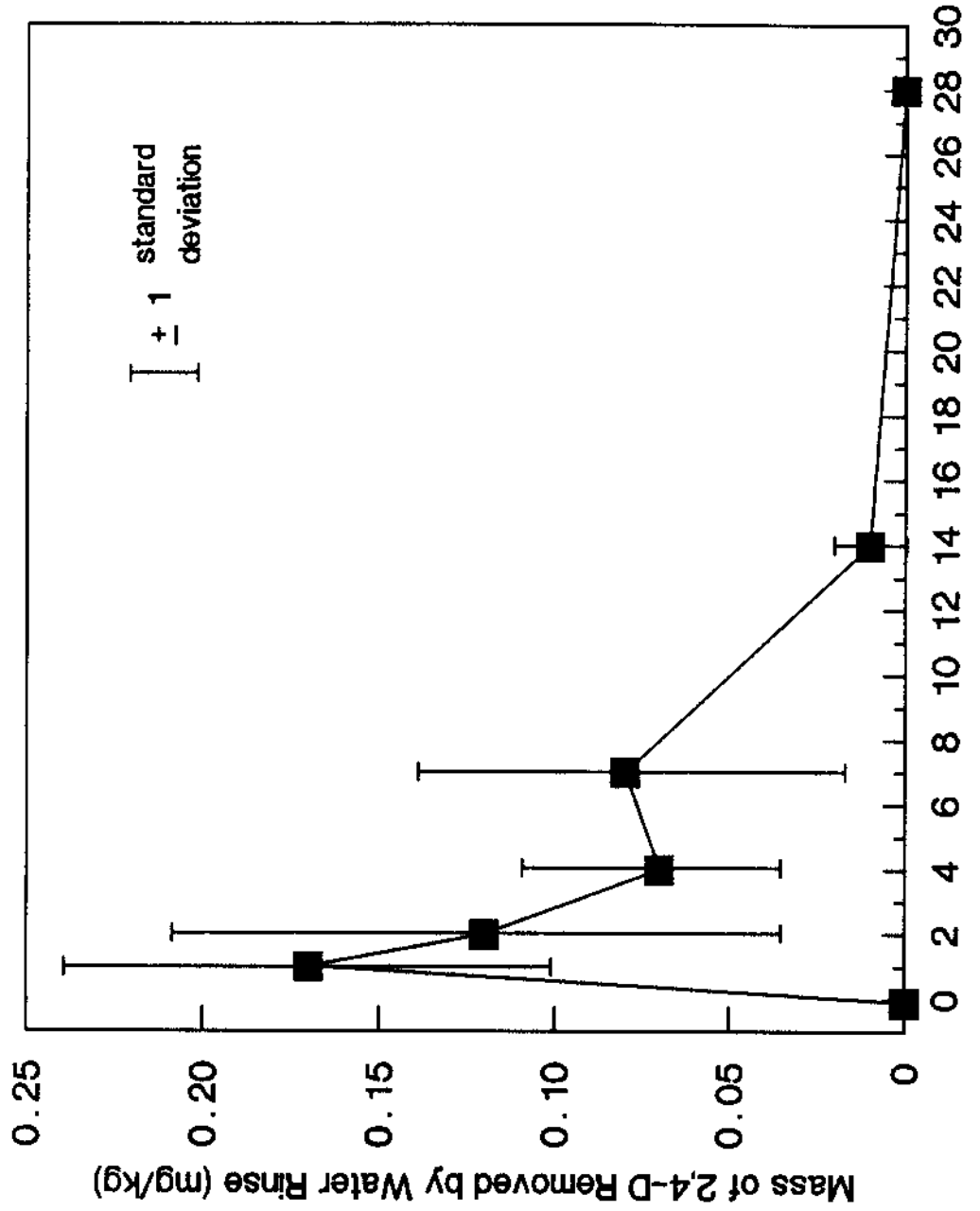

Figure 16. 2,4-D Removed From Water Hyacinths by Rinsing With Water (Field Validation Study).

predictors of mortality (Figure 17). For this reason, visual mortality estimates were used for model parameterization and validation.

Table 2 lists the data used for comparison of computer simulation model predictions with experimental observations for the field validation study. These comparisons are illustrated in Figures 18 and 19. Computer simulation model predictions were consistent with predictions of 2,4-D concentrations observed in plant tissues. Initial water concentrations were over predicted by the model possibly, as suggested with the microcosm study, this was due to mixing effects. Model validation was performed by regressing model predictions against observations. This relationship is illustrated in Figure 20. The r^2 for this regression is 0.884 indicating that the model accounted for 88% of the observed variability. The slope of predictions vs observations was not significantly different from 1.0 (0.929, p=0.373) and the intercept was not significantly different from 0.0 (0.136, p=0.274). The model predicted accurately what was actually observed in the Wallisville study and should be considered validated. The next level of model validation and modification must come from feedback from actual field operations (Reinert et al. 1986).

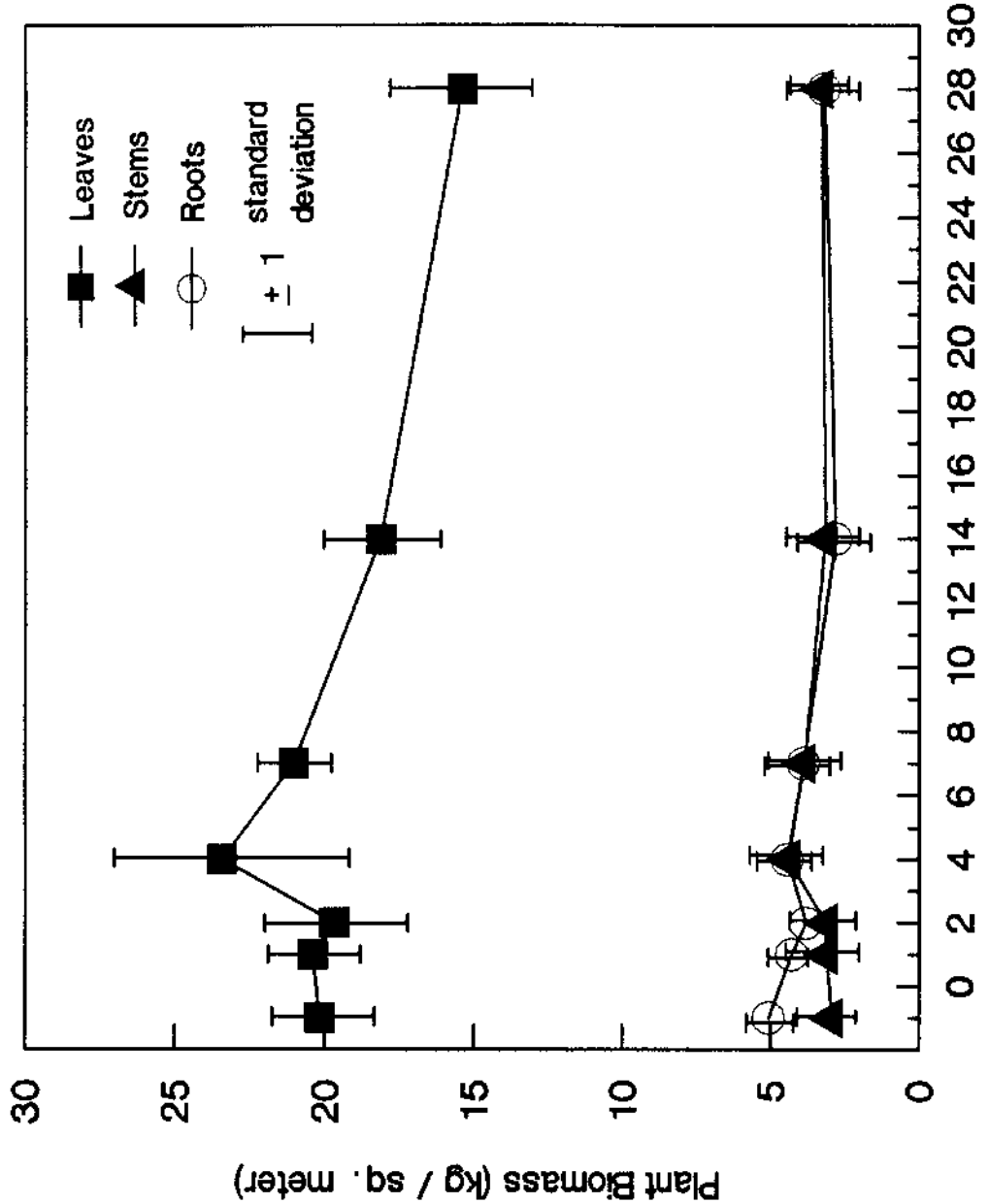

Figure 17. Change in Plant Biomass Measured During the Field Validation Study.

Table II. Data used for field study simulations. The values listed here are those used in the simulations illustrated in Figures 18 and 19. The symbol '*' in indicates that process is insignificant for the compound.

Parameter	Value	Reference
Average Depth of area to be Treated (meters)	2.0	This study
Water Flow Rate From Treated Area (meters/min.)	0.01	This study
Total Suspended Solids in Water (mg/l)	0.00	Clifford, et al. 1988
Depth of Active Sediment Layer (cm)	0.00	Clifford, et al. 1988
Sediment Water Content (%)	0.00	Clifford, et al. 1988
Sediment/Herbicide Diffusion Exchange Rate (cm/day)	0.00	Reinert and Rodgers,1986
Sedimentation Rate (cm/Year)	0.00	Clifford, et al. 1988
Sediment Resuspension Rate (cm/Year)	0.00	Clifford, et al. 1988
Active Ingredient Fraction of Herbicide (kg/l)	0.455	Herbicide label
Application Rate of Formulation (liters/hectare)	9.353	Herbicide label
Loss of Herbicide Due to Drift (%)	0.0	--
Herbicide Sediment Layer Partition Coefficient (Kp)	0.0	Reinert and Rodgers,1987
Herbicide Hydrolysis Halflife in Water (days)	*	Reinert and Rodgers,1987
Herbicide Hydrolysis Halflife in Sediment (days)	*	Reinert and Rodgers,1987
Herbicide Oxidation Halflife in Water (days)	*	Reinert and Rodgers,1987
Herbicide Oxidation Halflife in Sediment (days)	*	Reinert and Rodgers,1987
Herbicide Biotransformation Halflife in Water (days)	6.0	This study
Herbicide Biotransformation Halflife in Sediment (days)	6.0	This study
Herbicide Photolysis Halflife in Water (days)	*	Reinert and Rodgers,1987
Herbicide Volatilization Halflife in Water (days)	*	Reinert and Rodgers,1987
Percent Interception at This Plant Density	53.84	This study
Plant Biomass to be Treated (metric tons/hectare)	280.0	This study
Percent Dry Weight of Plant Tissue	7.84	This study

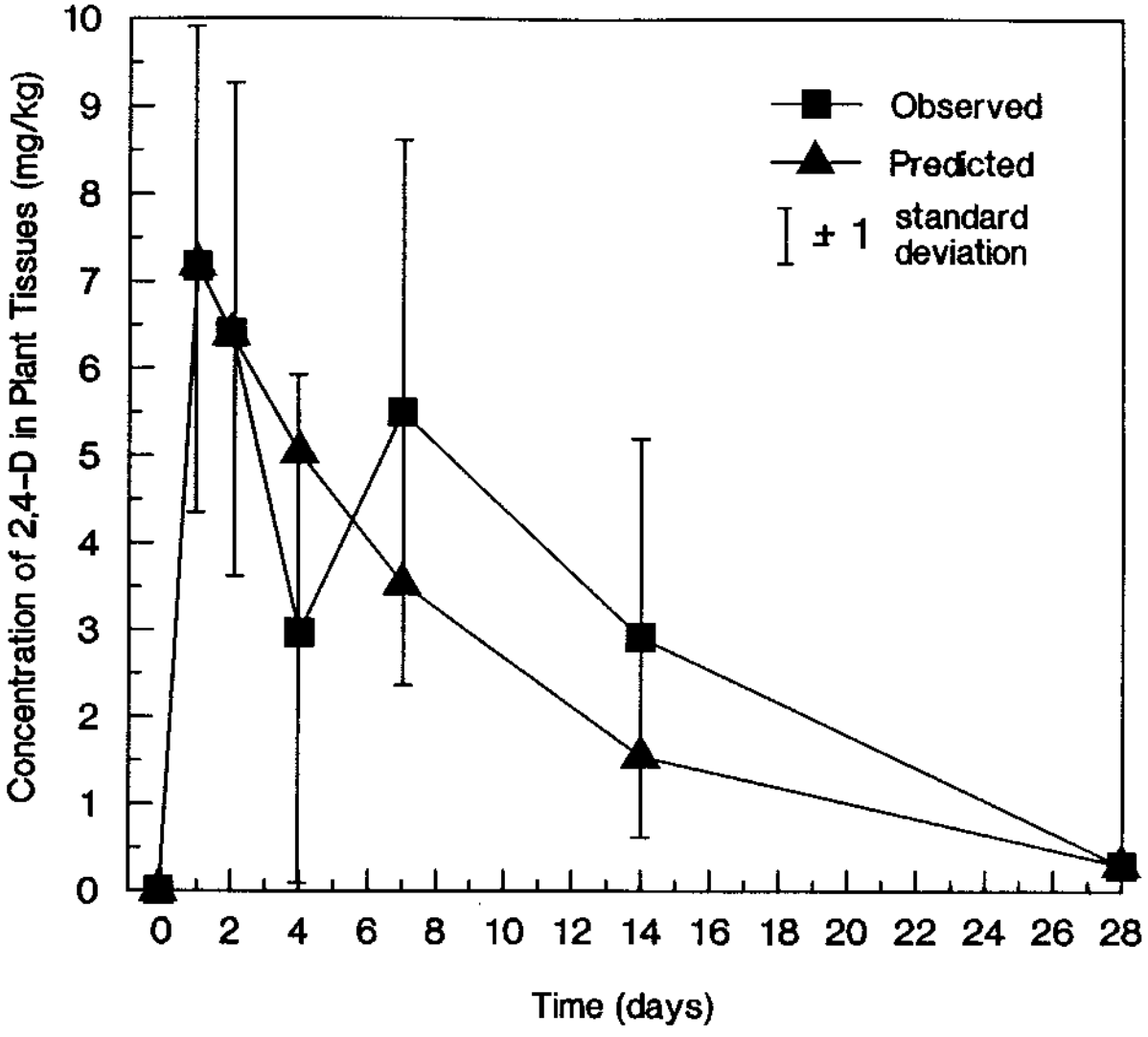

Figure 18. Comparison of Computer Simulation Model Predictions with Field Validation Study Observations for 2,4-D in Tissues of Water Hyacinth. Sediment Parameters Were Assigned Values of Zero Since No Sediment Samples Were Obtained During The Study.

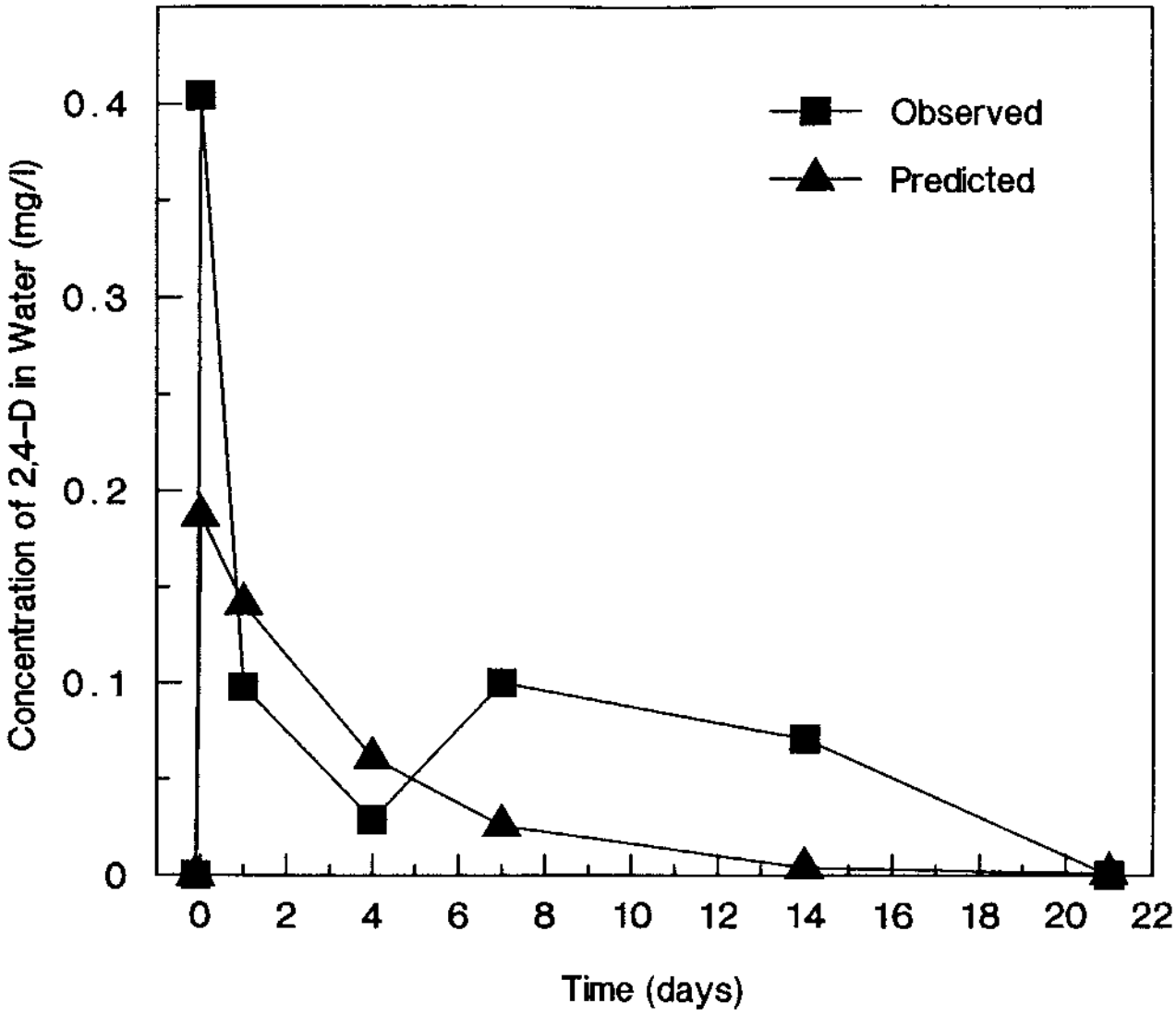

Figure 19. Comparison of Computer Simulation Model Predictions with Field Validation Study Observations for 2,4-D in Water. Sediment Parameters Were Assigned Values of Zero Since No Sediment Samples Were Obtained During The Study.

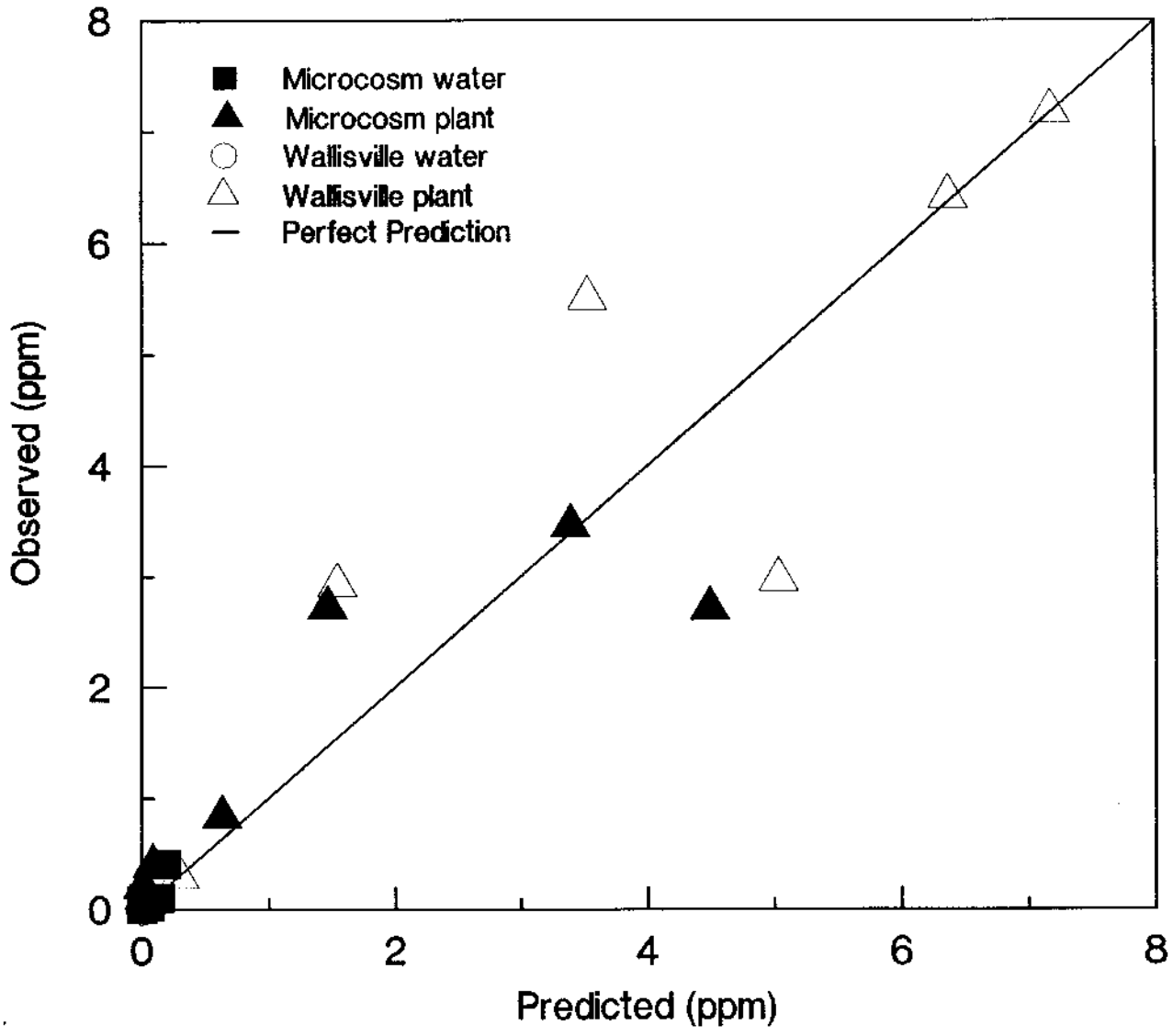

Figure 20. Computer Simulation Model Validation by Comparison of Predictions with Observations. The 45° Degree Line is the Line of Perfect Prediction.

The Computer Simulation Model

A flowchart for the model is illustrated in Figure 21 and the BASIC source code is listed in Appendix B. This computer simulation model is a valuable tool for predicting the effects of herbicides on target aquatic plant populations and supporting decisions made by trained management personnel. The model is not however, designed to make decisions regarding the use of herbicides for aquatic plant control, only to support them. Mathematical models are subject to predictive errors due either to design flaws (elements not considered by the programmer) or a failure to accurately reflect the complex nature of the system(s) being modeled. Although the data entered by the user may be the most accurate available, the model may incorrectly predict what actually occurs in the real world because of the complex nature of natural situations. Users are strongly cautioned to be aware that this model is only a decision support tool and should not be used to make decisions, only to support them. This model is not intended to be a substitute for common sense and professional training but, if used in combination with these, it can be a useful investigative tool.

One of the primary results of this modeling effort was identification of gaps in understanding of the processes affecting the effective use of herbicides for control of

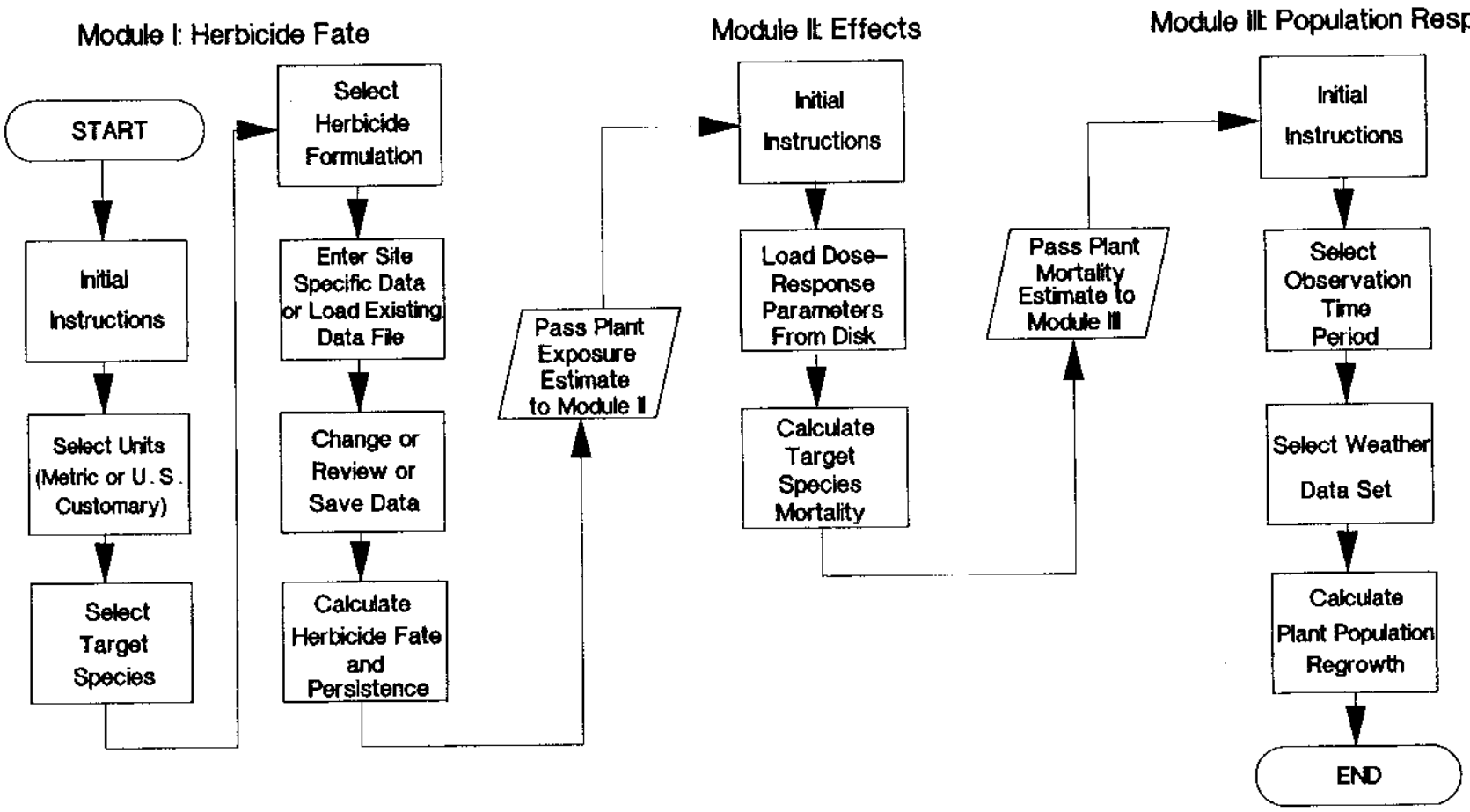

Figure 21. Generalized Flow Chart of The Coupled Herbicide Fate and Target Plant Population Response Model.

aquatic plants, specifically 2,4-D and water hyacinth. Model development forced close examination of available information and experimentation to derive relationships not described in the literature on the subject. Although the model itself is a valuable product as it can be a powerful predictive tool if used properly, the modeling effort generated some of the information needed to close the identified information gaps. Further modeling efforts to expand the current model to other herbicides and target plant populations can be expected to identify other information gaps and promote the research necessary to close these gaps. If for no reason other than this, this modeling effort was a success.

Model Structure

The computer simulation model is organized into three modules. The functions of Module I are: 1) selection of herbicide, 2) selection of target plant species, 3) data management, and 4) estimation of the fate and persistence of herbicides in aquatic environments. The function of Module II is estimation of the effect of herbicides on target plant species (in terms of percent control). The function of Module III is estimation of population response of target plant population following herbicide application.

Critical factors that were considered in the herbicide fate portion of the model (Module I) are transfer and

transformation of 2,4-D in the various media through which the herbicide may pass in reaching the target plants. In this case, transfer through both air and water were considered. The model is driven by the assumption that the target plant population must receive a certain "dose" or exposure (tissue concentration X time) in order to elicit the desired population response.

Efficiencies for each transfer (and sorption) and rate coefficients for transformations (biotransformation, photolysis, hydrolysis, etc.) are included in the calculations and the dose received by the macrophytes is calculated using a "mass balance" approach. This approach allows considerations such as "back calculation" to estimate minimum required initial concentrations as well as estimation of consequences of a particular concentration in a site specific situation.

The effects of herbicide treatment on the target plant population (Module II) are estimated by mathematical relationships which were developed from the data obtained in microcosm experiments (Figures 9 and 10). This Module estimates the percent reduction in the plant population and this estimate is passed along Module III (population response).

The target species response portion of the model (Module III) includes seasonal growth dynamics of water

hyacinth as regulated by critical environmental factors (e.g. light and temperature). This module has been adapted from the plant module of Howell et al. (1987) with slight modifications. Detailed description and validation of this portion of the model should be referenced in Howell et al. (1987).

Module I - Fate of Herbicides

Once a herbicide has been introduced into an aquatic system, the herbicide becomes distributed among various compartments of the system such as water, sediments and plants. The amount of herbicide to which a target plant population is exposed may be directly influenced by this compartmentalization. For instance, removal of herbicide from the water by processes resulting in sorption of the herbicide to sediments is one way that herbicide may be removed from direct contact with the target plant population. In addition to compartmentalization, target plant population exposure to a herbicide is not constant over time even if the herbicide is a conservative (usually inorganic) compound such as some of the copper complexes. Various processes affect the conversion of herbicides from the original parent compound to any of a number of intermediate compounds or degradation products, ultimately resulting in degradation of the compound to inert materials.

Some of the chemical and biochemical processes which drive transformations are: hydrolysis, oxidation, photolysis, volatilization, and biotransformation. Physical processes also affect the exposure of target plant species to herbicides. Some of these are: retention time, loss due to drift prior to herbicide interception by plants or introduction to the water, and rate of release of active ingredients from the herbicide formulation to the water. For this reason, exposure of target plant species to a herbicide in this model has been defined as the area under the curve of herbicide concentration vs. time and, to estimate this, an understanding of the fate and persistence of the herbicide is required. This exposure estimate is passed from Module I to Module II (effects) and consists of the total exposure of target plant species to the herbicide in terms of herbicide concentration vs. time or, mg 2,4-D per kg plant tissue wet weight times days (mg/kg-days).

The mass-balance and conservation of matter approach has been applied to herbicide compartmentalization and persistence in this model. The first step in the mass-balance calculation is determination of the masses of each component of the system. For the purposes of these calculations, a one hectare "window" is assumed. The mass of the water compartment is calculated from water depth and area. The mass of the plant (water hyacinth) component is a

user entered value. The mass of total suspended solids is calculated as mg/l of suspended solids times system volume. The masses of sediments and sediment interstitial water are calculated from volume of sediments and depth of "active" sediment layer. The mass of sediments is estimated from this based on a relationship between sediment volume and mass developed from data on reservoir sediments (Rodgers and Clifford, 1985). The relationship is:

sediment density (grams dry weight/cubic centimeter) =

$$-1.441 \times (\%water / 100) + 2.188$$

$$(N = 125,\ r\text{-square} = 0.83,\ p < 0.001)$$

The mass of interstitial water is calculated by subtraction of volume of sediment solids from sediment volume.

Mass of herbicide applied is calculated from application rate and active ingredient fraction less the amount lost to spray drift. Once the masses of all components of the system have been calculated, the next step is accounting for relative partition concentrations. The "effective mass" of each compartment is estimated by multiplying compartment mass and partition coefficient for each compartment, where the partition coefficient is defined as the concentration in a given compartment relative to the concentration of the herbicide in water. Therefore, the partition coefficient for water is, by definition, always equal to one. The reasoning behind the calculation of "effective masses" is that

mathematically, one unit of mass with a partition coefficient of two (for example) is equivalent to two units of mass with a partition coefficient of one. Once the "effective mass" has been calculated, each compartment has a "relative" partition coefficient of 1.0 and the compartments are now mathematically comparable. The sum of the effective masses of all compartments is the "effective mass" of the system. Division of the effective mass of a compartment by the effective mass of the system yields a fractional value which, when multiplied by the mass of herbicide in the system at that particular time, yields the mass of herbicide which would be present in that compartment at any time (assuming that the compartments are all in instantaneous equilibrium). In the case of water hyacinth, the plant compartment is uncoupled from the rest of the system and mass of herbicide in plants is calculated from percent interception. The concentration of herbicide in a given compartment is then readily calculated as mass of herbicide in the compartment divided by actual compartment mass.

Once equilibrium calculations have been performed for a given time interval, the mass of herbicide in the system is decremented by various fate processes rates through time. The mass of herbicide in each compartment is then calculated as described above.

The removal of herbicide from contact with the target plant population by the physical factors of herbicide transfer between the suspended solids and sediment compartments (by sedimentation and resuspension) and, water flow from the treated area, is then calculated. The calculations for sedimentation and resuspension modify the effective mass of the sediment compartment so that when the equilibrium calculations are performed for the next time interval, herbicide mass is shifted into or out of the sediment compartment. Suspended solids are considered to remain constant throughout the period even if net sedimentation is not zero. Water flow from the area is calculated by assuming that the area (a one hectare window) is square and the water is flowing from one side to the other. The amount of herbicide lost due to flow is calculated from the concentration in water times the amount of water lost per unit time, where the amount of water lost per unit time is the water flow rate (distance) divided by the time interval.

The final step in the herbicide fate calculations is estimation of exposure of the target plant species to herbicide. The area under the curve of herbicide concentration through time is calculated by mathematically determining the sum of the areas of each time increment under the plant tissue concentration curve.

This value (mg/kg-days) is then passed to Module II (effects).

Module II - Effects (Response) on Target Plant Species

The output from Module I (exposure, mg/kg-days) is passed to Module II as well as information regarding the display units selected, species selected, and other parameters required for the operation of the module. The function of this module is estimation of the degree of control of the target plant species obtained based upon exposure to the herbicide. This degree of control is estimated mathematically from the relationship illustrated in Figure 10. The maximum percent control currently allowed by the model is 98.0%. This allows sufficient remaining biomass to drive simulation of the regrowth of the population after herbicide treatment.

The output from this module is a plot of exposure (mg/kg-days) vs. percent control (mortality). The control achieved is indicated graphically and its numerical value is reported. The percent control achieved, initial plant density, mathematical units and other variables required for the operation of Module III are then passed to that module.

Module III - Population Response

Currently, the version of Module III available is for water hyacinth (Eichhornia crassipes). This module was adapted from the program written by Howell et al. (1987). The portions of this program that were adapted for use in Module III were those that deal with the growth of water hyacinth. Several routines that were added are: 1) multi-year operation and date entry, 2) cursor-driven weather data set selection, 3) graphic output of plant response, 4) printer or screen numerical output selection, 5) error trap routines, and 6) conversion of plant mass from kg / m^2 dry weight to tons / acre or metric tons / hectare wet weight. Further documentation on the operation and validation of this module can be obtained from the documentation report by Howell et al. (1987).

Conclusions

1) The primary route of exposure of water hyacinth to 2,4-D appears to be via contact of the emergent portions of the plants with concentrated sprays (hypotheses 1,2,3,4).
2) The concentration of 2,4-D in tissues of water hyacinth required to elicit a maximum mortality response is approximately 12 mg/kg plant wet weight (hypothesis 1).
3) The maximum observed plant mortality in both microcosm and field experiments was approximately 98% (hypothesis 1).

4) The observed halflife of 2,4-D in water was approximately 2.5 days in microcosm experiments and 6 days in the Wallisville field study.

5) Degree of interception of 2,4-D by water hyacinths as a function of plant density does play a role in achieved control of water hyacinth with 2,4-D (hypothesis 5).

6) The current version of the computer simulation model was validated using data from the microcosm and Wallisville, Texas field studys (hypothesis 6).

7) Plant tissue percent dry weight was determined to be 7.84% $\pm$ 4.96 (mean and standard deviation, N=41) and sediment percent dry weight was determined to be 75.82 $\pm$ 3.27 (N=77) in these experiments.

8) Computer simulation modeling is a valuable technique both for management decision support and identification of information gaps.

APPENDIX A

2,4-D ANALYTICAL PROTOCOL

Introduction:

This protocol was adapted from Rocchio (1988), Knapp (1979), and Moses (1985). The analytical method for 2,4-D (DMA) is based on the aqueous derivatization of 2,4-D using methanol and HCl. The methyl ester of 2,4-D (2,4-D-Me) is then analyzed on a gas-liquid chromatograph (Tracor 560) using an ECD. The column currently in use is a fused silica capillary column (SPB-5 packing material, 0.53 mm id, 15 meter length, Supelco # 2-5304). The carrier gas is nitrogen at a flow rate of 15.0 ml/min. The injection temperature is 225 °C, oven temperature is 158 °C, and the detector temperature is 300 °C. The syringe is pre-rinsed with pesticide-grade n-hexane. Injection volumes are 2.0 micro-liters.

Required Materials:

The materials listed below are for single samples.

Water Samples:

1) 4 ml sample.
2) Tissue culture tube.
3) 5 ml reagent-grade methanol.
4) 1.25 ml conc. HCl.
5) 60 °C waterbath.
6) 2 ml pesticide-grade n-hexane.
7) Vortexer.

Plant and Sediment Samples:

1) 30 g sample (5 for % dry weight, 25 for 2,4-D analysis).
2) Soxhlet extraction apparatus, soxhlet thimble.
3) 175 ml 0.5 N NaOH (pH > 12), boiling stones.
4) 250 ml separatory funnel.
5) 25 ml pesticide-grade pentane.
6) 50 ml reagent-grade Methanol.
7) 10 ml reagent-grade conc. HCl.

8) 6 ml pesticide-grade n-hexane.
9) 250 ml prescription bottle.

Gas Chromatograph:

1) Tracor 560 gas/liquid chromatograph or equivalent.

2) Column: Supelco # 2-5304 (fused silica capillary column, 0.53 mm id, 15 meter length, SPB-5 packing material).

Glassware Preparation:

All glassware should be rinsed with DI water with sufficient agitation to remove any particulate matter, rinsed with 10% HCl, rinsed again with DI water, rinsed with acetone, again with DI water and finally with pesticide-grade hexane. These steps are necessary to remove all contaminating organics which might otherwise be carried through the digestion/extraction process.

Sample Preparation:

Water Sample Preparation:

1) Water samples should be collected in acid-washed containers
and placed on ice or stored frozen prior to analysis.

2) Place 4 ml of sample in a tissue culture tube.

3) Add 5 ml reagent-grade methanol and 1.25 ml reagent-grade conc. HCl (addition order must be observed). Incubate in waterbath at 60 °C for 18-24 hours. Be sure to exclude light.

4) Add 2 ml pesticide-grade n-hexane.

5) Immediately prior to GC analysis, vortex sample for 5 minutes.

6) Analyze the hexane layer with GC.

Plant and Sediment Sample Preparation:

1) Plant and sediment samples may be frozen prior to analysis.

2) For sediment samples, a cellulose fiber soxhlet thimble MUST be used because the sediment may plug the glass frits on the bottom of glass thimbles and the apparatus may fail to cycle. A bed (0.5 cm) of boiling chips under the tube will ensure that the tube does not block the siphon outlet as it swells during the extraction process). For plant samples, a glass soxhlet thimble lined with glass wool is recommended.

3) Place 25 g wet sediment (or plant material ground in a mortar and pestle) into the thimble. Retain another 5 g sediment (or plants) for determination of percent dry weight (by drying at 104 °C for 24 hours).

4) For sediment samples, Place 175 ml 0.5 N NaOH (pH > 12) (0.25 N for plants) and boiling chips into the bottom of the digestion flask and place the thimble containing the sample into the cycling tube. Seat the cycling tube and condenser into place with sufficient stop-cock grease to prevent "freezing" of the glass elements.

5) Turn on the water supply to the condenser and ensure free flow. Turn on heating mantle and monitor temperature until a smooth boil is attained. Refluxing requires approximately 5 hours. The refluxing time is determined by a minimum of three "cycles". A "cycle" begins when the condenser begins to drip and terminates when the self-priming syphon on the cycling tube draws the extract back into the digestion flask.

6) The extract may be stored at 4 °C in the dark at this point.

7) Transfer the extract to a 250 ml separatory funnel and add 25 ml pesticide-grade pentane. Shake once for 5 minutes. Allow sample to stand for 20 minutes so that the emulsion layer will dissipate. Place the aqueous layer in a 250 ml prescription bottle and discard the pentane in an appropriate waste container. This step is essentially a "clean-up" step.

8) Add 50 ml reagent-grade Methanol to the extract. Acidify the sample (pH approx. 2) with 10 ml reagent-grade conc. HCl. NOTE: order of reagent addition must be observed.

9) Seal container and incubate in a 60 °C waterbath in the dark for 18-24 hours.

10) Transfer the derivatized extract to a 250 ml separatory funnel and add 2 ml pesticide-grade n-hexane. Shake gently for 5 minutes. Formation of emulsion layer is not as likely at this step as it is with the pentane clean-up step but excessive agitation is unnecessary.

11) Drain aqueous layer into the 250 ml prescription bottle.

12) Collect the hexane layer in a sample vial.

13) Return prescription bottle contents to the separatory funnel and repeat steps 9-11 (2 ml hexane, shake, save hexane) twice more (this makes a total of 3 extractions at 2 ml each for a final hexane/2,4-D-me volume of 6 ml).

14) Analyze hexane extract with GC.

APPENDIX B

BASIC Source Code Listing of The Computer Simulation Model

Subroutine INSTALL

```
START:
   DIM A$(24,2)
   DIM A(24,1)
   DIM F$(60)
   DIM B(25)
   DIM MENU$(10)
   DIM RESULT$(10)
   DIM FILESIN$(60)
   COMMON DSKID$,A$(),A(),F$(),B(),TYPE$,DIRECT$,UNITS$
   COMMON PPMDAYS,INITBIOM,DIR$,SPECNAME$,PERDRY
   COMMON CHEMNAME$,PRNTPLACE$,LINK$,PPATH$,DPATH$
   COMMON MENU$(),MAXITEM,RESULT$(),TITLE$,COUNT,CURBIOM
   LINK$ = "INSTALL"
   ON ERROR GOTO TRAP
   SCREEN 0,1,0,0
   OPEN "A:\DSKID.CHK" FOR INPUT AS #1
   INPUT #1,DSKID$
   CLOSE #1
   IF DSKID$ = "BOOT" OR DSKID$ = "HD" THEN GOTO BEGIN
   CLS
   LOCATE 12,15,0
   PRINT"Please Place Boot Disk in Drive A:"
   LOCATE 14,15,0
   PRINT"and Press Any Key to Continue"

   CHKCHOOSE:
      SEL$=INKEY$
      IF SEL$="" THEN GOTO CHKCHOOSE
      GOTO START

BEGIN:
   OPEN "A:\CONFIG.HRB" FOR INPUT AS #1
   INPUT #1,PPATH$,DPATH$
   CLOSE
   COLOR 14,1
   CLS
   LOCATE 4,21,0
   PRINT "Current Program Configuration is:"
   LOCATE 6,12,0
   PRINT "Program Disks are to be Run From Disk Drive ";PPATH$
   LOCATE 7,18,0
   PRINT "Data is to be Stored on Disk Drive ";DPATH$
   LOCATE 12,5,0
   PRINT"      Would You Like to Install This Program on Hard Disk?"
   LOCATE 15,5,0
   PRINT"                    Yes                          No"
   LOCATE 22,15,0
   PRINT "MOVE CURSOR TO DESIRED SELECTION AND PRESS <ENTER>"
   LOCATE 23,22,0
   PRINT "(USE ARROW KEYS [";CHR$(24);CHR$(26);CHR$(25);CHR$(27);
```

```
   PRINT "] TO MOVE CURSOR)"
   LOCATE 15,21,0
   COLOR 19
   PRINT CHR$(178)
   CHOICE$="Y"
   DEF SEG=0:POKE 1050,PEEK(1052)

CHOOSE:
   CURSOR$=INKEY$
   IF CURSOR$="" THEN GOTO CHOOSE
   CURSOR$=RIGHT$(CURSOR$,1)
   IF CURSOR$=CHR$(13) THEN GOTO CHOSEN2
   IF CURSOR$=CHR$(77) THEN GOTO NO2
   IF CURSOR$=CHR$(75) THEN GOTO YES2
   GOTO CHOOSE

YES2:
   LOCATE 15,46,0
   PRINT" "
   LOCATE 15,21,0
   PRINT CHR$(178)
   CHOICE$="Y"
   GOTO CHOOSE

NO2:
   LOCATE 15,21,0
   PRINT" "
   LOCATE 15,46,0
   PRINT CHR$(178)
   CHOICE$="N"
   GOTO CHOOSE

CHOSEN2:
   IF CHOICE$ = "N" THEN GOTO EXITINSTAL
   IF CHOICE$ <> "Y" THEN GOTO BEGIN

BEGININSTAL:
  COLOR 14,1
  CLS
  LOCATE 12,10,0
  PRINT "Please Type the Letter of Your Hard Drive. Select"
  LOCATE 13,10,0
  PRINT "Carefully, an Invalid Drive Letter Will Not Damage the"
  LOCATE 14,10,0
  PRINT "Program but, Proper Installation Will Fail."
  LOCATE 16,20,0
  PRINT "==>";

CHOOSEHD:
  SEL$ = INKEY$
  IF SEL$ = "" THEN GOTO CHOOSEHD
  IF ASC(SEL$) < 64 THEN INPUT"USE LETTERS ONLY, PRESS <ENTER>";X$
```

```
  IF ASC(SEL$) < 64 THEN GOTO BEGININSTAL
  IF ASC(SEL$) > 71 AND ASC(SEL$) < 97 THEN INPUT"INVALID, PRESS <ENTER>";X$
  IF ASC(SEL$) > 71 AND ASC(SEL$) < 97 THEN GOTO BEGININSTAL
  IF ASC(SEL$) > 102 THEN INPUT"INVALID, PRESS <ENTER>";X$
  IF ASC(SEL$) > 102 THEN GOTO BEGININSTAL
  PPATH$ = SEL$ + ":\"
  PRINT SEL$
  FOR I = 1 TO 500:NEXT I

CHOOSEDIRECT:
  CLS
  LOCATE 10,15,0
  PRINT "Enter Name of Directory (up to eight letters)"
  LOCATE 11,15,0
  PRINT "in Which to Install HERBICIDE Program"

CHOOSEHD2:
  LOCATE 12,15,0
  INPUT"==> ";DIRECT$
  FOR K = 1 TO LEN(DIRECT$)
    IF K = 9 THEN DIRECT$ = LEFT$(DIRECT$,8):GOTO ENDK
    IF MID$(DIRECT$,K,1) = "." THEN DIRECT$ = LEFT$(DIRECT$,K-1):GOTO ENDK
  ENDK:
  NEXT K
  TEMPFILE$ = ""
  FOR K = 1 TO LEN(DIRECT$)
    TEMPCHAR = ASC(MID$(DIRECT$,K,1))
    IF TEMPCHAR < 48 THEN GOTO ANOTHERK
    IF TEMPCHAR > 57 AND TEMPCHAR < 64 THEN GOTO ANOTHERK
    IF TEMPCHAR > 90 AND TEMPCHAR < 97 THEN GOTO ANOTHERK
    IF TEMPCHAR > 122 THEN GOTO ANOTHERK
    TEMPFILE$ = TEMPFILE$ + CHR$(TEMPCHAR)
  ANOTHERK:
  NEXT K
  DIRECT$ = TEMPFILE$
  IF DIRECT$ = "" THEN GOTO CHOOSEDIRECT
  LOCATE 13,15,0
  PRINT"SELECTION IS: ";PPATH$ + DIRECT$
  LOCATE 14,10,0
  INPUT "If this is Correct, Press <ENTER>, if not, Type: N";X$
  IF X$ = "N" OR X$ = "n" THEN GOTO BEGININSTAL
  CLS
  LOCATE 1,1,0
  PRINT"MAKING DIRECTORIES"
  SHELL "MD " + PPATH$ + DIRECT$
  SHELL "MD " + PPATH$ + DIRECT$ + "\HYACINTH"
  SHELL "MD " + PPATH$ + DIRECT$ + "\HYACINTH" + "\24DDMA"
  SHELL "MD " + PPATH$ + DIRECT$ + "\HYACINTH" + "\24DDMA\" + "DEFAULT"
  LOCATE 1,1,0
  PRINT"COPYING FILES     "
  SHELL "COPY A:HERBICID.EXE " + PPATH$ + DIRECT$
  SHELL "COPY A:INITTAL.PIC " + PPATH$ + DIRECT$
```

```
  SHELL "COPY A:HDPROG.BAT " + PPATH$ + DIRECT$ + "\H.BAT"
DISK1:
  CLS
  LOCATE 12,15,0
  PRINT"Please Place Program Disk I in Drive A:"
  LOCATE 14,15,0
  PRINT"and Press Any Key to Continue"
  OPEN "A:DSKID.CHK" FOR INPUT AS #1
  INPUT #1,DSKID$
  CLOSE #1
  IF DSKID$ = "PROG1" THEN GOTO CONTINSTAL

   CHK:
      SEL$=INKEY$
      IF SEL$="" THEN GOTO CHK
      GOTO DISK1

CONTINSTAL:
   CLS
   LOCATE 1,1,0
   PRINT "COPYING FILES"
   SHELL "COPY A:*.* " + PPATH$ + DIRECT$

DISK2:
  CLS
  LOCATE 12,15,0
  PRINT"Please Place Program Disk for Hyacinth in Drive A:"
  LOCATE 14,15,0
  PRINT"and Press Any Key to Continue"
  OPEN "A:DSKID.CHK" FOR INPUT AS #1
  INPUT #1,DSKID$
  CLOSE #1
  IF DSKID$ = "HYACINTH" THEN GOTO CONTINSTAL2

   CHK2:
      SEL$=INKEY$
      IF SEL$="" THEN GOTO CHK2
      GOTO DISK2

CONTINSTAL2:
   CLS
   LOCATE 1,1,0
   PRINT "COPYING FILES"
   SHELL "COPY A:*.* " + PPATH$ + DIRECT$

DATADISK:
  CLS
  LOCATE 12,15,0
  PRINT"Please Place Data Disk for Hyacinth and 2,4-D in Drive A:"
  LOCATE 14,15,0
  PRINT"and Press Any Key to Continue"
  OPEN "A:DSKID.CHK" FOR INPUT AS #1
```

```
  INPUT #1,DSKID$
  CLOSE #1
  IF DSKID$ = "DATA" THEN GOTO CONTINSTAL3

   CHK3:
      SEL$=INKEY$
      IF SEL$="" THEN GOTO CHK3
      GOTO DATADISK

CONTINSTAL3:
   CLS
   LOCATE 1,1,0
   PRINT"COPYING FILES"
   COMM1$ = "A:\HYACINTH\*.*"
   COMM2$ = PPATH$ + DIRECT$ + "\HYACINTH"
   SHELL "COPY " + COMM1$ + " " + COMM2$
   CLS
   LOCATE 1,1,0
   PRINT"COPYING FILES"
   COMM1$ = "A:\HYACINTH\24DDMA\*.*"
   COMM2$ = PPATH$ + DIRECT$ + "\HYACINTH\24DDMA"
   SHELL "COPY " + COMM1$ + " " + COMM2$
   CLS
   LOCATE 1,1,0
   PRINT"COPYING FILES"
   COMM1$ = "A:\HYACINTH\24DDMA\DEFAULT\*.*"
   COMM2$ = PPATH$ + DIRECT$ + "\HYACINTH\24DDMA\DEFAULT"
   SHELL "COPY " + COMM1$ + " " + COMM2$
   OPEN PPATH$ + DIRECT$ + "\DSKID.CHK" FOR OUTPUT AS #1
   WRITE #1,"HD"
   CLOSE
   OPEN PPATH$ + DIRECT$ + "\CONFIG.HRB" FOR OUTPUT AS #1
   WRITE #1,PPATH$ + DIRECT$ + "\"
   WRITE #1,PPATH$ + DIRECT$ + "\"
   CLOSE
   CLS
   LOCATE 10,1,0
   PRINT "  Installation Complete, Press <ENTER> to Exit Install Program"
   PRINT
   PRINT "  To Run Herbicide, Type: CD ";DIRECT$;
   PRINT "  From the ";PPATH$;" Prompt Then Type: H "
   PRINT
   INPUT "  ==>";X$
   COLOR 7,0
   CLS
   SHELL PPATH$
   SYSTEM

EXITINSTAL:
  COLOR 14,1
  CLS
  LOCATE 10,1,0
```

```
  PRINT"   Installation Aborted. Press <ENTER> to Exit Install Program"
  INPUT"   ==>";X$
  COLOR 7,0
  CLS
  SYSTEM

TRAP:
  SCREEN 2
  SCREEN 0,1,0,0
  COLOR 7,1
  CLS
  PRINT " ";TAB(30);"ERROR INFORMATION"
  COLOR 14,1
  PRINT "═══════════════════════════════════════";
  PRINT "═══════════════════════════════════════"
  DEF SEG=0:POKE 1050,PEEK(1052)
KNOWN:
  IF ERR < 24 THEN GOTO UNKNOWN
  IF ERR = 26 THEN GOTO UNKNOWN
  IF ERR > 27 AND ERR < 52 THEN GOTO UNKNOWN
  IF ERR > 53 AND ERR < 61 THEN GOTO UNKNOWN
  IF ERR > 61 AND ERR < 68 THEN GOTO UNKNOWN
  IF ERR = 69 THEN GOTO UNKNOWN
  IF ERR > 72 AND ERR < 76 THEN GOTO UNKNOWN
  IF ERR > 76 THEN GOTO UNKNOWN
  LOCATE 8,10,0
  PRINT "AN ERROR HAS OCCURRED DURING THE OPERATION OF THIS PROGRAM:"
  LOCATE 10,5,0
  IF ERR = 24 THEN PRINT "DISK DRIVE OR PRINTER IS NOT TURNED ON";
    IF ERR = 24 THEN PRINT "OR PLUGGED IN"
  IF ERR = 25 THEN PRINT "HARDWARE MALFUNCTION"
  IF ERR = 27 THEN PRINT "THE PRINTER IS OUT OF PAPER"
  IF ERR = 52 THEN PRINT "THE FILE NAME IS INVALID. RENAME THE FILE."
  IF ERR = 61 THEN PRINT "YOU WILL HAVE TO USE A NEW DISK. THIS ONE IS FULL"
  IF ERR = 68 THEN PRINT "TARGET DEVICE DOES NOT EXIST, THIS PROGRAM"
    IF ERR = 68 THEN PRINT "ATTEMPTED TO ACCESS A DISK DRIVE OR PRINTER"
    IF ERR = 68 THEN PRINT "WHICH IS NOT PRESENT. SOFTWARE MUST BE RE-"
    IF ERR = 68 THEN PRINT "CONFIGURED TO PERFORM THE REQUESTED ACTION"
  IF ERR = 70 THEN PRINT "THE DISK IS WRITE PROTECTED"
  IF ERR = 53 OR ERR = 76 THEN PRINT "PROBABLY THE WRONG DISK IS IN";
    IF ERR = 53 OR ERR = 76 THEN PRINT " THE DISK DRIVE."
  IF ERR = 71 THEN PRINT "EITHER THE DISK DRIVE DOOR IS OPEN OR THERE";
    IF ERR = 71 THEN PRINT " IS NO DISK IN THE DRIVE"
  IF ERR = 72 THEN PRINT "THE DISKETTE IS PROBABLY BAD. USE A NEW DISKETTE"
  GOTO PAUSE
UNKNOWN:
  LOCATE 10,5,0
  PRINT "AN ERROR HAS BEEN IDENTIFIED IN THIS PROGRAM. PLEASE CONTACT"
  LOCATE 11,5,0
  PRINT "YOUR SOFTWARE SUPPORT REPRESENTATIVE AND REPORT THAT ERROR"
  LOCATE 12,5,0
  PRINT "NUMBER";ERR;" OCCURRED IN SUB-ROUTINE: ";LINK$
```

```
  LOCATE 20,28,0
  COLOR 20
  PRINT "PRESS ANY KEY TO CONTINUE"
  COLOR 14,1
  GOTO SCAN
PAUSE:
  LOCATE 20,15,0
  COLOR 20
  PRINT "CORRECT THIS ERROR AND PRESS ANY KEY TO CONTINUE"
  COLOR 14,1
  CLOSE
SCAN:
  SEL$ = INKEY$
  IF SEL$ = "" THEN GOTO SCAN
  CLS
  RESUME START
```

Subroutine HERBICID

```
START:
   DIM A$(24,2)
   DIM A(24,1)
   DIM F$(60)
   DIM B(25)
   DIM MENU$(10)
   DIM RESULT$(10)
   COMMON DSKID$,A$(),A(),F$(),B(),TYPE$,DIRECT$,UNITS$
   COMMON PPMDAYS,INITBIOM,DIR$,SPECNAME$,PERDRY
   COMMON CHEMNAME$,PRNTPLACE$,LINK$,PPATH$,DPATH$
   COMMON MENU$(),MAXITEM,RESULT$(),TITLE$,COUNT,CURBIOM
   LINK$ = "HERBICID"
   ON ERROR GOTO TRAP

INIT:
   SCREEN 1
   COLOR 7,1,0
   OPEN "CONFIG.HRB" FOR INPUT AS #1
   INPUT #1,PPATH$,DPATH$
   CLOSE
   DEF SEG=&HB800
   BLOAD PPATH$ + "INITIAL.PIC",0

MENU:
   MAXITEM = 4
   MENU$(1)  = "1. Instructions & Help"
   MENU$(2)  = "2. Issue a DOS Command"
   MENU$(3)  = "3. Begin HERBICIDE Program"
   MENU$(4)  = "4. Exit HERBICIDE Program"
   RESULT$(1) = "HELP1"
   RESULT$(2) = "DOSCOM"
   RESULT$(3) = "SELECT"
   RESULT$(4) = "QUIT"
```

```
   TITLE$ = "                                    Main Menu"

CHOOSE:
   SEL$=INKEY$
   IF SEL$="" THEN GOTO CHOOSE
   CLOSE

DISK1:
  SCREEN 2
  SCREEN 0,1,0,0
  COLOR 14,1
  CLS
  OPEN "DSKID.CHK" FOR INPUT AS #1
  INPUT #1,DSKID$
  CLOSE #1
  IF DSKID$ = "PROG1" OR DSKID$ = "HD" THEN CHAIN PPATH$ + "MENU"
  LOCATE 12,15,0
  PRINT"Please Place Program Disk I in Drive A:"
  LOCATE 14,15,0
  PRINT"and Press Any Key to Continue"

   CHK:
      SEL$=INKEY$
      IF SEL$="" THEN GOTO CHK
      GOTO DISK1

TRAP:
  SCREEN 2
  SCREEN 0,1,0,0
  COLOR 7,1
  CLS
  PRINT " ";TAB(30);"ERROR INFORMATION"
  COLOR 14,1
  PRINT "═══════════════════════════════════════";
  PRINT "═══════════════════════════════════════"
  DEF SEG=0:POKE 1050,PEEK(1052)
KNOWN:
  IF ERR < 24 THEN GOTO UNKNOWN
  IF ERR = 26 THEN GOTO UNKNOWN
  IF ERR > 27 AND ERR < 52 THEN GOTO UNKNOWN
  IF ERR > 53 AND ERR < 61 THEN GOTO UNKNOWN
  IF ERR > 61 AND ERR < 68 THEN GOTO UNKNOWN
  IF ERR = 69 THEN GOTO UNKNOWN
  IF ERR > 72 AND ERR < 76 THEN GOTO UNKNOWN
  IF ERR > 76 THEN GOTO UNKNOWN
  LOCATE 8,10,0
  PRINT "AN ERROR HAS OCCURRED DURING THE OPERATION OF THIS PROGRAM:"
  LOCATE 10,5,0
  IF ERR = 24 THEN PRINT "DISK DRIVE OR PRINTER IS NOT TURNED ON";
    IF ERR = 24 THEN PRINT "OR PLUGGED IN"
  IF ERR = 25 THEN PRINT "HARDWARE MALFUNCTION"
  IF ERR = 27 THEN PRINT "THE PRINTER IS OUT OF PAPER"
```

```
  IF ERR = 52 THEN PRINT "THE FILE NAME IS INVALID. RENAME THE FILE."
  IF ERR = 61 THEN PRINT "YOU WILL HAVE TO USE A NEW DISK. THIS ONE IS FULL"
  IF ERR = 68 THEN PRINT "TARGET DEVICE DOES NOT EXIST, THIS PROGRAM"
    IF ERR = 68 THEN PRINT "ATTEMPTED TO ACCESS A DISK DRIVE OR PRINTER"
    IF ERR = 68 THEN PRINT "WHICH IS NOT PRESENT. SOFTWARE MUST BE RE-"
    IF ERR = 68 THEN PRINT "CONFIGURED TO PERFORM THE REQUESTED ACTION"
  IF ERR = 70 THEN PRINT "THE DISK IS WRITE PROTECTED"
  IF ERR = 53 OR ERR = 76 THEN PRINT "PROBABLY THE WRONG DISK IS IN";
    IF ERR = 53 OR ERR = 76 THEN PRINT " THE DISK DRIVE."
  IF ERR = 71 THEN PRINT "EITHER THE DISK DRIVE DOOR IS OPEN OR THERE";
    IF ERR = 71 THEN PRINT " IS NO DISK IN THE DRIVE"
  IF ERR = 72 THEN PRINT "THE DISKETTE IS PROBABLY BAD. USE A NEW DISKETTE"
  GOTO PAUSE
UNKNOWN:
  LOCATE 10,5,0
  PRINT "AN ERROR HAS BEEN IDENTIFIED IN THIS PROGRAM. PLEASE CONTACT"
  LOCATE 11,5,0
  PRINT "YOUR SOFTWARE SUPPORT REPRESENTATIVE AND REPORT THAT ERROR"
  LOCATE 12,5,0
  PRINT "NUMBER";ERR;" OCCURRED IN SUB-ROUTINE: ";LINK$
  LOCATE 20,28,0
  COLOR 20
  PRINT "PRESS ANY KEY TO CONTINUE"
  COLOR 14,1
  GOTO SCAN
PAUSE:
  LOCATE 20,15,0
  COLOR 20
  PRINT "CORRECT THIS ERROR AND PRESS ANY KEY TO CONTINUE"
  COLOR 14,1
  CLOSE
SCAN:
  SEL$ = INKEY$
  IF SEL$ = "" THEN GOTO SCAN
  CLS
  RESUME START
```

Subroutine MENU1

```
START:
   DIM A$(24,2)
   DIM A(24,1)
   DIM F$(60)
   DIM B(25)
   DIM MENU$(10)
   DIM RESULT$(10)
   COMMON DSKID$,A$(),A(),F$(),B(),TYPE$,DIRECT$,UNITS$
   COMMON PPMDAYS,INITBIOM,DIR$,SPECNAME$,PERDRY
   COMMON CHEMNAME$,PRNTPLACE$,LINK$,PPATH$,DPATH$
   COMMON MENU$(),MAXITEM,RESULT$(),TITLE$,COUNT,CURBIOM
   LINK$ = "MENU1"
   KEY(1) ON
```

```
    ON KEY(1) GOSUB HELP
    ON ERROR GOTO TRAP
    SCREEN 0,1,0,0
    COLOR 4,1,6
    IF DSKID$ = "HD" THEN GOTO ALLOCATE
    OPEN PPATH$ + "DSKID.CHK" FOR INPUT AS #1
    INPUT #1,DSKID$
    CLOSE #1
    IF DSKID$ = "PROG1" OR DSKID$ = "HD" THEN GOTO ALLOCATE
    CLS
    LOCATE 12,15,0
    PRINT"Please Place Program Disk 1 in Drive ";PPATH$
    LOCATE 14,15,0
    PRINT"and Press Any Key to Continue"

    CHKCHOOSE:
       SEL$=INKEY$
       IF SEL$="" THEN GOTO CHKCHOOSE
       GOTO START

    ALLOCATE:
       '********************* # MENU ITEMS AND **********************
       '******************* HIGHLIGHT ALLOCATION ********************
    MENU$(1) = "1. Waterhyacinth and 2,4-D (DMA)"
    MENU$(2) = "2. Help and Instructions"
    MENU$(3) = "3. Exit HERBICIDE Program"
    RESULT$(1) = "INPUT"
    RESULT$(2) = "HELP1"
    RESULT$(3) = "QUIT"
    MAXITEM = 3
    TITLE$ = "                    Select Target Plant Species and Herbicide"
       MINITEM = 1
       MINHIGH = 5
       MAXHIGH = MINHIGH + (2 * MAXITEM) -2
       COUNT   = MINITEM
       HIGHPOS = MINHIGH
       GOTO SETUP

DONE:
    IF COUNT <> 1 THEN GOTO CHOICETWO
    DIRECT$   = "HYACINTH"
    DIR$      = "\24DDMA"
    SPECNAME$ = "Waterhyacinth"
    CHEMNAME$ = "2,4-D (DMA)"
    TYPE$ = "FLOATING"
CHOICETWO:
    IF COUNT <> 2 THEN GOTO CHOICETHREE
    DIRECT$   = "MILFOIL"
    DIR$      = "ENDOTHAL"
    SPECNAME$ = "Milfoil"
    CHEMNAME$ = "Endothall"
    TYPE$     = "SUBMERGED"
```

```
CHOICETHREE:

   CHAIN PPATH$ + RESULT$(COUNT)

SETUP:
   COLOR 10,1,6
   CLS
   COLOR 4,7,6
   LOCATE 1,1,0
   PRINT " ";TAB(80) " "
   LOCATE 2,1,0
   PRINT " ";TAB(80) " "
   LOCATE 3,1,0
   PRINT " ";TAB(80) " "
   LOCATE 1,1,0
   PRINT TITLE$
   LOCATE 2,18,0
   PRINT"use arrow keys [";CHR$(24);
   PRINT CHR$(25);"] to highlight selection"
   LOCATE 3,24,0
   PRINT"press <ENTER> to make selection"
   COLOR 4,2,6
   LOCATE 25,1,0
   PRINT " ";TAB(80) " ";
   LOCATE 25,25,0
   PRINT "PRESS <F1> FOR HELP AT ANY TIME";
   COLOR 1,10,6
   LOCATE 5,20,0
   PRINT MENU$(1)
   COLOR 10,1,6
   FOR I = 2 TO MAXITEM
     LOCATE 3+(I*2),20,0
     PRINT MENU$(I)
   NEXT I
   GOTO COUNTCHECK

COUNTCHECK:
   DEF SEG=0:POKE 1050,PEEK(1052)
   IF COUNT   < MINITEM THEN COUNT   = MINITEM
   IF COUNT   > MAXITEM THEN COUNT   = MAXITEM
   IF HIGHPOS < MINHIGH THEN HIGHPOS = MINHIGH
   IF HIGHPOS > MAXHIGH THEN HIGHPOS = MAXHIGH
   GOTO REPEAT

REPEAT:
   HIGHLITE$    = INKEY$
   IF HIGHLITE$ = "" THEN GOTO REPEAT
   HIGHLITE$    = RIGHT$(HIGHLITE$,1)
   IF HIGHLITE$ = CHR$(13) THEN GOTO DONE
   IF HIGHLITE$ = "P" THEN GOTO DOWN
   IF HIGHLITE$ = "H" THEN GOTO UP
   GOTO REPEAT
```

```
    DOWN:
       IF COUNT = MAXITEM THEN GOTO TOPAGAIN
       COUNT    = (HIGHPOS-3)/2
       GOTO DOWNONE

       DOWNONE:
       LOCATE HIGHPOS,20,0
       PRINT MENU$(COUNT)
       HIGHPOS = HIGHPOS + 2
       COLOR 1,10,6
       LOCATE HIGHPOS,20,0
       PRINT MENU$(COUNT+1)
       COLOR 10,1,6
       COUNT = COUNT+1
       GOTO COUNTCHECK

       TOPAGAIN:
       LOCATE HIGHPOS,20,0
       PRINT MENU$(COUNT)
       HIGHPOS = MINHIGH + 2
       COUNT   = MINITEM + 1
       GOTO UPONE

    UP:
       IF COUNT = MINITEM THEN GOTO BOTTOMAGAIN
       COUNT    = (HIGHPOS-3)/2
       GOTO UPONE

       UPONE:
       LOCATE HIGHPOS,20,0
       PRINT MENU$(COUNT)
       HIGHPOS = HIGHPOS - 2
       COLOR 1,10,6
       LOCATE HIGHPOS,20,0
       PRINT MENU$(COUNT-1)
       COLOR 10,1,6
       COUNT = COUNT-1
       GOTO COUNTCHECK

       BOTTOMAGAIN:
       LOCATE HIGHPOS,20,0
       PRINT MENU$(COUNT)
       HIGHPOS = MAXHIGH - 2
       COUNT   = MAXITEM - 1
       GOTO DOWNONE

HELP:
  CHAIN PPATH$ + "HELP1"

TRAP:
  SCREEN 2
```

```
  SCREEN 0,1,0,0
  COLOR 7,1
  CLS
  PRINT " ";TAB(30);"ERROR INFORMATION"
  COLOR 14,1
  PRINT "═══════════════════════════════════════";
  PRINT "═══════════════════════════════════════"
  DEF SEG=0:POKE 1050,PEEK(1052)
KNOWN:
  IF ERR < 24 THEN GOTO UNKNOWN
  IF ERR = 26 THEN GOTO UNKNOWN
  IF ERR > 27 AND ERR < 52 THEN GOTO UNKNOWN
  IF ERR > 53 AND ERR < 61 THEN GOTO UNKNOWN
  IF ERR > 61 AND ERR < 68 THEN GOTO UNKNOWN
  IF ERR = 69 THEN GOTO UNKNOWN
  IF ERR > 72 AND ERR < 76 THEN GOTO UNKNOWN
  IF ERR > 76 THEN GOTO UNKNOWN
  LOCATE 8,10,0
  PRINT "AN ERROR HAS OCCURRED DURING THE OPERATION OF THIS PROGRAM:"
  LOCATE 10,5,0
  IF ERR = 24 THEN PRINT "DISK DRIVE OR PRINTER IS NOT TURNED ON";
    IF ERR = 24 THEN PRINT "OR PLUGGED IN"
  IF ERR = 25 THEN PRINT "HARDWARE MALFUNCTION"
  IF ERR = 27 THEN PRINT "THE PRINTER IS OUT OF PAPER"
  IF ERR = 52 THEN PRINT "THE FILE NAME IS INVALID. RENAME THE FILE."
  IF ERR = 61 THEN PRINT "YOU WILL HAVE TO USE A NEW DISK. THIS ONE IS FULL"
  IF ERR = 68 THEN PRINT "TARGET DEVICE DOES NOT EXIST, THIS PROGRAM"
    IF ERR = 68 THEN PRINT "ATTEMPTED TO ACCESS A DISK DRIVE OR PRINTER"
    IF ERR = 68 THEN PRINT "WHICH IS NOT PRESENT. SOFTWARE MUST BE RE-"
    IF ERR = 68 THEN PRINT "CONFIGURED TO PERFORM THE REQUESTED ACTION"
  IF ERR = 70 THEN PRINT "THE DISK IS WRITE PROTECTED"
  IF ERR = 53 OR ERR = 76 THEN PRINT "PROBABLY THE WRONG DISK IS IN";
    IF ERR = 53 OR ERR = 76 THEN PRINT " THE DISK DRIVE."
  IF ERR = 71 THEN PRINT "EITHER THE DISK DRIVE DOOR IS OPEN OR THERE";
    IF ERR = 71 THEN PRINT " IS NO DISK IN THE DRIVE"
  IF ERR = 72 THEN PRINT "THE DISKETTE IS PROBABLY BAD. USE A NEW DISKETTE"
  GOTO PAUSE
UNKNOWN:
  LOCATE 10,5,0
  PRINT "AN ERROR HAS BEEN IDENTIFIED IN THIS PROGRAM. PLEASE CONTACT"
  LOCATE 11,5,0
  PRINT "YOUR SOFTWARE SUPPORT REPRESENTATIVE AND REPORT THAT ERROR"
  LOCATE 12,5,0
  PRINT "NUMBER";ERR;" OCCURRED IN SUB-ROUTINE: ";LINK$
  LOCATE 20,28,0
  COLOR 20
  PRINT "PRESS ANY KEY TO CONTINUE"
  COLOR 14,1
  GOTO SCAN
PAUSE:
  LOCATE 20,15,0
  COLOR 20
```

```
  PRINT "CORRECT THIS ERROR AND PRESS ANY KEY TO CONTINUE"
  COLOR 14,1
  CLOSE
SCAN:
  SEL$ = INKEY$
  IF SEL$ = "" THEN GOTO SCAN
  CLS
  RESUME START

                                    Subroutine MENU
START:
   DIM A$(24,2)
   DIM A(24,1)
   DIM F$(60)
   DIM B(25)
   DIM MENU$(10)
   DIM RESULT$(10)
   COMMON DSKID$,A$(),A(),F$(),B(),TYPE$,DIRECT$,UNITS$
   COMMON PPMDAYS,INITBIOM,DIR$,SPECNAME$,PERDRY
   COMMON CHEMNAME$,PRNTPLACE$,LINK$,PPATH$,DPATH$
   COMMON MENU$(),MAXITEM,RESULT$(),TITLE$,COUNT,CURBIOM
   LINK$ = "MENU"
   KEY(1) ON
   ON KEY(1) GOSUB HELP
   ON ERROR GOTO TRAP
   SCREEN 0,1,0,0
   COLOR 4,1,6
   IF DSKID$ = "HD" THEN GOTO ALLOCATE
   OPEN PPATH$ + "DSKID.CHK" FOR INPUT AS #1
   INPUT #1,DSKID$
   CLOSE #1
   IF DSKID$ = "PROG1" OR DSKID$ = "HD" THEN GOTO ALLOCATE
   CLS
   LOCATE 12,15,0
   PRINT"Please Place Program Disk 1 in Drive ";PPATH$
   LOCATE 14,15,0
   PRINT"and Press Any Key to Continue"

   CHKCHOOSE:
      SEL$=INKEY$
      IF SEL$="" THEN GOTO CHKCHOOSE
      GOTO START

   ALLOCATE:
      '********************* # MENU ITEMS AND **********************
      '******************** HIGHLIGHT ALLOCATION ********************
      MINITEM = 1
      MINHIGH = 5
      MAXHIGH = MINHIGH + (2 * MAXITEM) -2
      COUNT   = MINITEM
      HIGHPOS = MINHIGH
      GOTO SETUP
```

```
DONE:
   CHAIN PPATH$ + RESULT$(COUNT)

SETUP:
   COLOR 10,1,6
   CLS
   COLOR 4,7,6
   LOCATE 1,1,0
   PRINT " ";TAB(80) " "
   LOCATE 2,1,0
   PRINT " ";TAB(80) " "
   LOCATE 3,1,0
   PRINT " ";TAB(80) " "
   LOCATE 1,1,0
   PRINT TITLE$
   LOCATE 2,18,0
   PRINT"use arrow keys [";CHR$(24);
   PRINT CHR$(25);"] to highlight selection"
   LOCATE 3,24,0
   PRINT"press <ENTER> to make selection"
   COLOR 4,2,6
   LOCATE 25,1,0
   PRINT " ";TAB(80) " ";
   LOCATE 25,25,0
   PRINT "PRESS <F1> FOR HELP AT ANY TIME";
   COLOR 1,10,6
   LOCATE 5,20,0
   PRINT MENU$(1)
   COLOR 10,1,6
   FOR I = 2 TO MAXITEM
     LOCATE 3+(I*2),20,0
     PRINT MENU$(I)
   NEXT I
   GOTO COUNTCHECK

COUNTCHECK:
   DEF SEG=0:POKE 1050,PEEK(1052)
   IF COUNT   < MINITEM THEN COUNT   = MINITEM
   IF COUNT   > MAXITEM THEN COUNT   = MAXITEM
   IF HIGHPOS < MINHIGH THEN HIGHPOS = MINHIGH
   IF HIGHPOS > MAXHIGH THEN HIGHPOS = MAXHIGH
   GOTO REPEAT

REPEAT:
   HIGHLITE$    = INKEY$
   IF HIGHLITE$ = "" THEN GOTO REPEAT
   HIGHLITE$    = RIGHT$(HIGHLITE$,1)
   IF HIGHLITE$ = CHR$(13) THEN GOTO DONE
   IF HIGHLITE$ = "P" THEN GOTO DOWN
   IF HIGHLITE$ = "H" THEN GOTO UP
   GOTO REPEAT
```

```
    DOWN:
       IF COUNT = MAXITEM THEN GOTO TOPAGAIN
       COUNT    = (HIGHPOS-3)/2
       GOTO DOWNONE

       DOWNONE:
       LOCATE HIGHPOS,20,0
       PRINT MENU$(COUNT)
       HIGHPOS = HIGHPOS + 2
       COLOR 1,10,6
       LOCATE HIGHPOS,20,0
       PRINT MENU$(COUNT+1)
       COLOR 10,1,6
       COUNT = COUNT+1
       GOTO COUNTCHECK

       TOPAGAIN:
       LOCATE HIGHPOS,20,0
       PRINT MENU$(COUNT)
       HIGHPOS = MINHIGH + 2
       COUNT   = MINITEM + 1
       GOTO UPONE

    UP:
       IF COUNT = MINITEM THEN GOTO BOTTOMAGAIN
       COUNT    = (HIGHPOS-3)/2
       GOTO UPONE

       UPONE:
       LOCATE HIGHPOS,20,0
       PRINT MENU$(COUNT)
       HIGHPOS = HIGHPOS - 2
       COLOR 1,10,6
       LOCATE HIGHPOS,20,0
       PRINT MENU$(COUNT-1)
       COLOR 10,1,6
       COUNT = COUNT-1
       GOTO COUNTCHECK

       BOTTOMAGAIN:
       LOCATE HIGHPOS,20,0
       PRINT MENU$(COUNT)
       HIGHPOS = MAXHIGH - 2
       COUNT   = MAXITEM - 1
       GOTO DOWNONE

HELP:
  CHAIN PPATH$ + "HELP1"

TRAP:
  SCREEN 2
```

```
  SCREEN 0,1,0,0
  COLOR 7,1
  CLS
  PRINT " ";TAB(30);"ERROR INFORMATION"
  COLOR 14,1
  PRINT "═══════════════════════════════════════";
  PRINT "═══════════════════════════════════════"
  DEF SEG=0:POKE 1050,PEEK(1052)
KNOWN:
  IF ERR < 24 THEN GOTO UNKNOWN
  IF ERR = 26 THEN GOTO UNKNOWN
  IF ERR > 27 AND ERR < 52 THEN GOTO UNKNOWN
  IF ERR > 53 AND ERR < 61 THEN GOTO UNKNOWN
  IF ERR > 61 AND ERR < 68 THEN GOTO UNKNOWN
  IF ERR = 69 THEN GOTO UNKNOWN
  IF ERR > 72 AND ERR < 76 THEN GOTO UNKNOWN
  IF ERR > 76 THEN GOTO UNKNOWN
  LOCATE 8,10,0
  PRINT "AN ERROR HAS OCCURRED DURING THE OPERATION OF THIS PROGRAM:"
  LOCATE 10,5,0
  IF ERR = 24 THEN PRINT "DISK DRIVE OR PRINTER IS NOT TURNED ON";
    IF ERR = 24 THEN PRINT "OR PLUGGED IN"
  IF ERR = 25 THEN PRINT "HARDWARE MALFUNCTION"
  IF ERR = 27 THEN PRINT "THE PRINTER IS OUT OF PAPER"
  IF ERR = 52 THEN PRINT "THE FILE NAME IS INVALID. RENAME THE FILE."
  IF ERR = 61 THEN PRINT "YOU WILL HAVE TO USE A NEW DISK. THIS ONE IS FULL"
  IF ERR = 68 THEN PRINT "TARGET DEVICE DOES NOT EXIST, THIS PROGRAM"
    IF ERR = 68 THEN PRINT "ATTEMPTED TO ACCESS A DISK DRIVE OR PRINTER"
    IF ERR = 68 THEN PRINT "WHICH IS NOT PRESENT. SOFTWARE MUST BE RE-"
    IF ERR = 68 THEN PRINT "CONFIGURED TO PERFORM THE REQUESTED ACTION"
  IF ERR = 70 THEN PRINT "THE DISK IS WRITE PROTECTED"
  IF ERR = 53 OR ERR = 76 THEN PRINT "PROBABLY THE WRONG DISK IS IN";
    IF ERR = 53 OR ERR = 76 THEN PRINT " THE DISK DRIVE."
  IF ERR = 71 THEN PRINT "EITHER THE DISK DRIVE DOOR IS OPEN OR THERE";
    IF ERR = 71 THEN PRINT " IS NO DISK IN THE DRIVE"
  IF ERR = 72 THEN PRINT "THE DISKETTE IS PROBABLY BAD. USE A NEW DISKETTE"
  GOTO PAUSE
UNKNOWN:
  LOCATE 10,5,0
  PRINT "AN ERROR HAS BEEN IDENTIFIED IN THIS PROGRAM. PLEASE CONTACT"
  LOCATE 11,5,0
  PRINT "YOUR SOFTWARE SUPPORT REPRESENTATIVE AND REPORT THAT ERROR"
  LOCATE 12,5,0
  PRINT "NUMBER";ERR;" OCCURRED IN SUB-ROUTINE: ";LINK$
  LOCATE 20,28,0
  COLOR 20
  PRINT "PRESS ANY KEY TO CONTINUE"
  COLOR 14,1
  GOTO SCAN
PAUSE:
  LOCATE 20,15,0
  COLOR 20
```

```
  PRINT "CORRECT THIS ERROR AND PRESS ANY KEY TO CONTINUE"
  COLOR 14,1
  CLOSE
SCAN:
  SEL$ = INKEY$
  IF SEL$ = "" THEN GOTO SCAN
  CLS
  RESUME START
```

Subroutine DOSCOM

```
START:
   DIM A$(24,2)
   DIM A(24,1)
   DIM F$(60)
   DIM B(25)
   DIM MENU$(10)
   DIM RESULT$(10)
   COMMON DSKID$,A$(),A(),F$(),B(),TYPE$,DIRECT$,UNITS$
   COMMON PPMDAYS,INITBIOM,DIR$,SPECNAME$,PERDRY
   COMMON CHEMNAME$,PRNTPLACE$,LINK$,PPATH$,DPATH$
   COMMON MENU$(),MAXITEM,RESULT$(),TITLE$,COUNT,CURBIOM
   LINK$ = "DOSCOM"
   ON ERROR GOTO TRAP
   SCREEN 0,1,0,0
   COLOR 4,1,6
   IF DSKID$ = "HD" THEN GOTO DOSCOM
   OPEN PPATH$ + "DSKID.CHK" FOR INPUT AS #1
   INPUT #1,DSKID$
   CLOSE #1
   IF DSKID$ = "PROG1" OR DSKID$ = "HD" THEN GOTO DOSCOM
   CLS
   LOCATE 12,15,0
   PRINT"Please Place Program Disk 1 in Drive ";PPATH$
   LOCATE 14,15,0
   PRINT"and Press Any Key to Continue"

   CHKCHOOSE:
      SEL$=INKEY$
      IF SEL$="" THEN GOTO CHKCHOOSE
      GOTO START

DOSCOM:
  COLOR 14,1
  CLS
  LOCATE 12,18,0
  PRINT "Type DOS Command Below and Press <ENTER>"
  LOCATE 14,18,0
  PRINT "or Press <ENTER> to Return to the Menu"
  LOCATE 16,10,0
  INPUT "==> ";DOSCOM$
  IF DOSCOM$ = "" THEN CHAIN PPATH$ + "MENU"
```

```
  COLOR 0,0,0
  CLS
  SHELL DOSCOM$
  COLOR 20
  LOCATE 25,28,0
  PRINT "<Press Any Key to Continue>";
  CHOOSE:
     SEL$ = INKEY$:IF SEL$ = "" THEN GOTO CHOOSE
  COLOR 10,1,6
  CLS
  CHAIN PPATH$ + "MENU"

TRAP:
  SCREEN 2
  SCREEN 0,1,0,0
  COLOR 7,1
  CLS
  PRINT " ";TAB(30);"ERROR INFORMATION"
  COLOR 14,1
  PRINT "═══════════════════════════════════════";
  PRINT "═══════════════════════════════════════"
  DEF SEG=0:POKE 1050,PEEK(1052)
KNOWN:
  IF ERR < 24 THEN GOTO UNKNOWN
  IF ERR = 26 THEN GOTO UNKNOWN
  IF ERR > 27 AND ERR < 52 THEN GOTO UNKNOWN
  IF ERR > 53 AND ERR < 61 THEN GOTO UNKNOWN
  IF ERR > 61 AND ERR < 68 THEN GOTO UNKNOWN
  IF ERR = 69 THEN GOTO UNKNOWN
  IF ERR > 72 AND ERR < 76 THEN GOTO UNKNOWN
  IF ERR > 76 THEN GOTO UNKNOWN
  LOCATE 8,10,0
  PRINT "AN ERROR HAS OCCURRED DURING THE OPERATION OF THIS PROGRAM:"
  LOCATE 10,5,0
  IF ERR = 24 THEN PRINT "DISK DRIVE OR PRINTER IS NOT TURNED ON";
    IF ERR = 24 THEN PRINT "OR PLUGGED IN"
  IF ERR = 25 THEN PRINT "HARDWARE MALFUNCTION"
  IF ERR = 27 THEN PRINT "THE PRINTER IS OUT OF PAPER"
  IF ERR = 52 THEN PRINT "THE FILE NAME IS INVALID. RENAME THE FILE."
  IF ERR = 61 THEN PRINT "YOU WILL HAVE TO USE A NEW DISK. THIS ONE IS FULL"
  IF ERR = 68 THEN PRINT "TARGET DEVICE DOES NOT EXIST, THIS PROGRAM"
    IF ERR = 68 THEN PRINT "ATTEMPTED TO ACCESS A DISK DRIVE OR PRINTER"
    IF ERR = 68 THEN PRINT "WHICH IS NOT PRESENT. SOFTWARE MUST BE RE-"
    IF ERR = 68 THEN PRINT "CONFIGURED TO PERFORM THE REQUESTED ACTION"
  IF ERR = 70 THEN PRINT "THE DISK IS WRITE PROTECTED"
  IF ERR = 53 OR ERR = 76 THEN PRINT "PROBABLY THE WRONG DISK IS IN";
    IF ERR = 53 OR ERR = 76 THEN PRINT " THE DISK DRIVE."
  IF ERR = 71 THEN PRINT "EITHER THE DISK DRIVE DOOR IS OPEN OR THERE";
    IF ERR = 71 THEN PRINT " IS NO DISK IN THE DRIVE"
  IF ERR = 72 THEN PRINT "THE DISKETTE IS PROBABLY BAD. USE A NEW DISKETTE"
  GOTO PAUSE
UNKNOWN:
```

```
  LOCATE 10,5,0
  PRINT "AN ERROR HAS BEEN IDENTIFIED IN THIS PROGRAM. PLEASE CONTACT"
  LOCATE 11,5,0
  PRINT "YOUR SOFTWARE SUPPORT REPRESENTATIVE AND REPORT THAT ERROR"
  LOCATE 12,5,0
  PRINT "NUMBER";ERR;" OCCURRED IN SUB-ROUTINE: ";LINK$
  LOCATE 20,28,0
  COLOR 20
  PRINT "PRESS ANY KEY TO CONTINUE"
  COLOR 14,1
  GOTO SCAN
PAUSE:
  LOCATE 20,15,0
  COLOR 20
  PRINT "CORRECT THIS ERROR AND PRESS ANY KEY TO CONTINUE"
  COLOR 14,1
  CLOSE
SCAN:
  SEL$ = INKEY$
  IF SEL$ = "" THEN GOTO SCAN
  CLS
  RESUME START
```

Subroutine HELP1

```
START:
   DIM A$(24,2)
   DIM A(24,1)
   DIM F$(60)
   DIM T$(60)
   DIM B(25)
   DIM MENU$(10)
   DIM RESULT$(10)
   COMMON DSKID$,A$(),A(),F$(),B(),TYPE$,DIRECT$,UNITS$
   COMMON PPMDAYS,INITBIOM,DIR$,SPECNAME$,PERDRY
   COMMON CHEMNAME$,PRNTPLACE$,LINK$,PPATH$,DPATH$
   COMMON MENU$(),MAXITEM,RESULT$(),TITLE$,COUNT,CURBIOM
   KEY 1,"Z":KEY OFF
   ON ERROR GOTO TRAP
   SCREEN 0,1,0,0
   COLOR 4,1,6

DSKID:
   IF DSKID$ = "HD" THEN GOTO SETUP
   OPEN PPATH$ + "dskid.chk" FOR INPUT AS #1
   INPUT #1,DSKID$
   CLOSE
   IF DSKID$ = "PROG1" OR DSKID$ = "HD" THEN GOTO SETUP
   LOCATE 12,15,0
   PRINT"Please Place Program Disk 1 in Drive ";PPATH$
   LOCATE 14,15,0
   PRINT"and Press Any Key to Continue"
```

```
CHKCHOOSE:
   SEL$=INKEY$
   IF SEL$="" THEN GOTO CHKCHOOSE
   GOTO START

SETUP:
   OPEN PPATH$ + "help.txt" AS #1 LEN=79
   FIELD #1,78 AS TEXTIN$

TOP:
   COLOR 10,1,1
   CLS
   LOCATE 5,5,0
   PRINT"This is the BEGINNING of the HELP facility"
   LOCATE 7,5,0
   PRINT"To use this facility:"
   LOCATE 9,5,0
   PRINT"The"
   COLOR 4
   LOCATE 9,9,0
   PRINT"page-down"
   COLOR 10
   LOCATE 9,19,0
   PRINT"(pgdn) and"
   COLOR 4
   LOCATE 9,30,0
   PRINT"page-up"
   COLOR 10
   LOCATE 9,38,0
   PRINT"(pgup) keys move you"
   LOCATE 11,5,0
   PRINT"Up and Down through the text."
   LOCATE 13,5,0
   PRINT"The"
   COLOR 4
   LOCATE 13,9,0
   PRINT"ESCAPE"
   COLOR 10
   LOCATE 13,16,0
   PRINT"key returns you to the main menu"
   LOCATE 15,5,0
   COLOR 4
   PRINT"F1"
   COLOR 10
   LOCATE 15,8,0
   PRINT"invokes the HELP INDEX"

CHOOSE1:
   SEL$=INKEY$
   IF SEL$="" THEN GOTO CHOOSE1
   IF SEL$="Z" THEN GOTO INDEX
```

```
    SEL$=RIGHT$(SEL$,1)
    IF SEL$="Q" OR SEL$ = "P" THEN GOTO BEGINSET
    IF SEL$=CHR$(27) THEN GOTO QUIT
    GOTO CHOOSE1

BEGINSET:
    TXTSTART=1:TXTSTOP=23

BEGIN:
    CLS
    LOCATE 25,1,0
    COLOR 2,3
    PRINT " ";TAB(80);" ";
    COLOR 4
    LOCATE 25,10,0
    PRINT "PRESS <F1> FOR HELP INDEX OR <ESC> TO RETURN TO PROGRAM";
    LOCATE 1,1,0
    COLOR 10,1
    FOR TXT = TXTSTART TO TXTSTOP
    IF TXT < 1 THEN GOTO TOP
    GET #1,TXT
    IF ASC(LEFT$(TEXTIN$,1)) = 0 THEN GOTO BOTTOM
    PRINT TEXTIN$;
    NEXT TXT
    DEF SEG=0:POKE 1050,PEEK(1052)

CHOOSE2:
    SEL$=INKEY$:IF SEL$="" THEN GOTO CHOOSE2
    IF SEL$="2" THEN GOTO INDEX
    SEL$=RIGHT$(SEL$,1)
    IF SEL$="P" OR SEL$ = "Q" THEN TXTSTART=TXTSTART+23:TXTSTOP=TXTSTOP+23:GOTO
BEGIN
    IF SEL$="I" OR SEL$ = "H" THEN TXTSTART=TXTSTART-23:TXTSTOP=TXTSTOP-23:GOTO
BEGIN
    IF SEL$=CHR$(27) THEN GOTO QUIT
    GOTO CHOOSE2

BOTTOM:
    COLOR 10,1,1
    CLS
    LOCATE 5,5,0
    PRINT"This is the END of the HELP facility"
    LOCATE 7,5,0
    PRINT"To continue using this facility:"
    LOCATE 9,5,0
    PRINT"The"
    COLOR 4
    LOCATE 9,9,0
    PRINT"page-down"
    COLOR 10
    LOCATE 9,19,0
    PRINT"(pgdn) and"
```

```
    COLOR 4
    LOCATE 9,30,0
    PRINT"page-up"
    COLOR 10
    LOCATE 9,38,0
    PRINT"(pgup) keys move you"
    LOCATE 11,5,0
    PRINT"Up and Down through the text."
    LOCATE 13,5,0
    PRINT"The"
    COLOR 4
    LOCATE 13,9,0
    PRINT"ESCAPE"
    COLOR 10
    LOCATE 13,16,0
    PRINT"key returns you to the main menu"
    LOCATE 15,5,0
    COLOR 4
    PRINT"F1"
    COLOR 10
    LOCATE 15,8,0
    PRINT"invokes the HELP INDEX"

CHOOSE3:
    SEL$=INKEY$
    IF SEL$="" THEN GOTO CHOOSE3
    IF SEL$="Z" THEN GOTO INDEX
    SEL$=RIGHT$(SEL$,1)
    IF SEL$ <> "H" AND SEL$ <> "I" THEN GOTO CHOOSE3
    TXTSTART=TXTSTART-23
    TXTSTOP=TXTSTOP-23
    GOTO BEGIN
    IF SEL$=CHR$(27) THEN GOTO QUIT
    GOTO CHOOSE3

QUIT:
    CLOSE #1
    CHAIN PPATH$ + LINK$

INDEX:
    J=34
    T$(1)="HELP FACILITY INSTRUCTIONS"
    T$(2)="HERBICIDE GENERAL INSTRUCTIONS"
    T$(3)="BACKUP COPIES"
    T$(4)="CHANGING DATA"
    T$(5)="CURSOR"
    T$(6)="DATA"
    T$(7)="DATA DISKS"
    T$(8)="DATA FILES"
    T$(9)="DEFAULTS"
    T$(10)="DISKS"
    T$(11)="FATE"
```

```
    T$(12)="FILE NAMES"
    T$(13)="GRAPHS"
    T$(14)="HERBICIDES"
    T$(15)="LAG COEFFICIENT"
    T$(16)="LOADING DATA"
    T$(17)="MODULES"
    T$(18)="PARAMETERS:WATER"
    T$(19)="PARAMETERS:SEDIMENT"
    T$(20)="PARAMETERS:HERBICIDE"
    T$(21)="PARAMETERS:HERBICIDE"
    T$(22)="PARAMETERS:HERBICIDE"
    T$(23)="PARAMETERS:PLANTS"
    T$(24)="PLANT SPECIES"
    T$(25)="PPM-DAYS"
    T$(26)="PRINTER"
    T$(27)="PRINT-SCREEN"
    T$(28)="RESPONSE COEFFICIENT"
    T$(29)="RESPONSE MODEL"
    T$(30)="SAVING DATA"
    T$(31)="SCREEN"
    T$(32)="TREATMENT DATES"
    T$(33)="UNITS"
    T$(34)="WEATHER DATASETS"
    COLOR 10,1,1
    CLS
    CUR=1
    FIN=20
    PRTLIN=1
    PRTCOL=5
    LOCATE 23,1,0
    PRINT"MOVE ARROW TO TOPIC (USE ARROW KEYS) AND PRESS <enter>"

INDEXSET:
    FOR I=CUR TO FIN
    PRTLIN=PRTLIN+1
    IF I>J THEN GOTO INDEXMOVE
    LOCATE PRTLIN,PRTCOL,0
    PRINT I;" "; T$(I)
    NEXT I
    IF I<J THEN PRTCOL=PRTCOL+40
    CUR=CUR+20
    FIN=FIN+20
    PRTLIN=1
    GOTO INDEXSET

INDEXMOVE:
    ROW=2
    COL=4
    LOCATE ROW,COL,0
    COLOR 7
    PRINT "=>"
    DEF SEG=0:POKE 1050,PEEK(1052)
```

```
CHOOSE4:
   CURSOR$=INKEY$
   IF CURSOR$="" THEN GOTO CHOOSE4
   IF CURSOR$=CHR$(13) THEN GOTO DONE
   CURSOR$=RIGHT$(CURSOR$,1)
   IF CURSOR$=CHR$(75) THEN GOTO LEFTARROW
   IF CURSOR$=CHR$(72) THEN GOTO UPARROW
   IF CURSOR$=CHR$(77) THEN GOTO RIGHTARROW
   IF CURSOR$=CHR$(80) THEN GOTO DOWNARROW
   LOCATE ROW+1,COL,0:PRINT "  ":LOCATE ROW,COL,0:PRINT"=>"

LEFTARROW:
   COL=COL-40:IF COL<4 THEN COL=4:GOTO CHOOSE4
   LOCATE ROW,COL+40,0:PRINT "  ":LOCATE ROW,COL,0:PRINT"=>"
   GOTO CHOOSE4

UPARROW:
   ROW=ROW-1:IF ROW<2 THEN ROW=2:GOTO CHOOSE4
   LOCATE ROW+1,COL,0:PRINT "  ":LOCATE ROW,COL,0:PRINT"=>"
   GOTO CHOOSE4

RIGHTARROW:
   COL=COL+40:IF COL>44 THEN COL=44:GOTO CHOOSE4
   LOCATE ROW,COL-40,0:PRINT "  ":LOCATE ROW,COL,0:PRINT"=>"
   GOTO CHOOSE4

DOWNARROW:
   ROW=ROW+1:IF ROW>21 THEN ROW=21:GOTO CHOOSE4
   LOCATE ROW-1,COL,0:PRINT "  ":LOCATE ROW,COL,0:PRINT"=>"
   GOTO CHOOSE4

DONE:
   IF COL=4 THEN COLN=0
   IF COL=44 THEN COLN=20
   TOPIC=(ROW-1)+COLN
   IF TOPIC > J THEN GOTO CHOOSE4
   TOPIC$=T$(TOPIC)
   IF TOPIC=1 THEN GOTO TOP
   TXTSTART=(23*TOPIC)-45
   TXTSTOP=TXTSTART+22
   CLS
   COLOR 10,1,1
   GOTO BEGIN

TRAP:
  SCREEN 2
  SCREEN 0,1,0,0
  COLOR 7,1
  CLS
  PRINT " ";TAB(30);"ERROR INFORMATION"
  COLOR 14,1
```

```
   PRINT "═══════════════════════════════════════";
   PRINT "═══════════════════════════════════════"
   DEF SEG=0:POKE 1050,PEEK(1052)
KNOWN:
   IF ERR < 24 THEN GOTO UNKNOWN
   IF ERR = 26 THEN GOTO UNKNOWN
   IF ERR > 27 AND ERR < 52 THEN GOTO UNKNOWN
   IF ERR > 53 AND ERR < 61 THEN GOTO UNKNOWN
   IF ERR > 61 AND ERR < 68 THEN GOTO UNKNOWN
   IF ERR = 69 THEN GOTO UNKNOWN
   IF ERR > 72 AND ERR < 76 THEN GOTO UNKNOWN
   IF ERR > 76 THEN GOTO UNKNOWN
   LOCATE 8,10,0
   PRINT "AN ERROR HAS OCCURRED DURING THE OPERATION OF THIS PROGRAM:"
   LOCATE 10,5,0
   IF ERR = 24 THEN PRINT "DISK DRIVE OR PRINTER IS NOT TURNED ON";
     IF ERR = 24 THEN PRINT "OR PLUGGED IN"
   IF ERR = 25 THEN PRINT "HARDWARE MALFUNCTION"
   IF ERR = 27 THEN PRINT "THE PRINTER IS OUT OF PAPER"
   IF ERR = 52 THEN PRINT "THE FILE NAME IS INVALID. RENAME THE FILE."
   IF ERR = 61 THEN PRINT "YOU WILL HAVE TO USE A NEW DISK. THIS ONE IS FULL!"
   IF ERR = 68 THEN PRINT "TARGET DEVICE DOES NOT EXIST, THIS PROGRAM"
     IF ERR = 68 THEN PRINT "ATTEMPTED TO ACCESS A DISK DRIVE OR PRINTER"
     IF ERR = 68 THEN PRINT "WHICH IS NOT PRESENT. SOFTWARE MUST BE RE-"
     IF ERR = 68 THEN PRINT "CONFIGURED TO PERFORM THE REQUESTED ACTION"
   IF ERR = 70 THEN PRINT "THE DISK IS WRITE PROTECTED"
   IF ERR = 53 OR ERR = 76 THEN PRINT "PROBABLY THE WRONG DISK IS IN";
     IF ERR = 53 OR ERR = 76 THEN PRINT " THE DISK DRIVE."
   IF ERR = 71 THEN PRINT "EITHER THE DISK DRIVE DOOR IS OPEN OR THERE";
     IF ERR = 71 THEN PRINT " IS NO DISK IN THE DRIVE"
   IF ERR = 72 THEN PRINT "THE DISKETTE IS PROBABLY BAD. USE A NEW DISKETTE"
   GOTO PAUSE
UNKNOWN:
   LOCATE 10,5,0
   PRINT "AN ERROR HAS BEEN IDENTIFIED IN THIS PROGRAM. PLEASE CONTACT"
   LOCATE 11,5,0
   PRINT "YOUR SOFTWARE SUPPORT REPRESENTATIVE AND REPORT THAT ERROR"
   LOCATE 12,5,0
   PRINT "NUMBER";ERR;" OCCURRED IN SUB-ROUTINE: HELP"
   LOCATE 20,28,0
   COLOR 20
   PRINT "PRESS ANY KEY TO CONTINUE"
   COLOR 14,1
   GOTO SCAN
PAUSE:
   LOCATE 20,15,0
   COLOR 20
   PRINT "CORRECT THIS ERROR AND PRESS ANY KEY TO CONTINUE"
   COLOR 14,1
   CLOSE
SCAN:
   SEL$ = INKEY$
```

```
   IF SEL$ = "" THEN GOTO SCAN
   CLS
   RESUME START
```

Subroutine QUIT

```
START:
   DIM A$(24,2)
   DIM A(24,1)
   DIM F$(60)
   DIM B(25)
   DIM MENU$(10)
   DIM RESULT$(10)
   COMMON DSKID$,A$(),A(),F$(),B(),TYPE$,DIRECT$,UNITS$
   COMMON PPMDAYS,INITBIOM,DIR$,SPECNAME$,PERDRY
   COMMON CHEMNAME$,PRNTPLACE$,LINK$,PPATH$,DPATH$
   COMMON MENU$(),MAXITEM,RESULT$(),TITLE$,COUNT,CURBIOM
   ON ERROR GOTO TRAP

BEGIN:
   COLOR 14,1
   CLS
   LOCATE 12,5,0
   PRINT"              Are You Sure You Want To QUIT HERBICIDE?"
   LOCATE 15,5,0
   PRINT"                    No                          Yes"
   LOCATE 21,5,0
   PRINT "IF YOU DO NOT LOAD A DISK FILE, THE DEFAULT DATA SET";
   PRINT " WILL BE LOADED."
   LOCATE 22,15,0
   PRINT "MOVE CURSOR TO DESIRED SELECTION AND PRESS <ENTER>"
   LOCATE 23,22,0
   PRINT "(USE ARROW KEYS [";CHR$(24);CHR$(26);CHR$(25);CHR$(27);
   PRINT "] TO MOVE CURSOR)"
   LOCATE 15,21,0
   COLOR 19
   PRINT CHR$(178)
   CHOICE$="N"
   DEF SEG=0:POKE 1050,PEEK(1052)

CHOOSE1:
   CURSOR$=INKEY$
   IF CURSOR$="" THEN GOTO CHOOSE1
   CURSOR$=RIGHT$(CURSOR$,1)
   IF CURSOR$=CHR$(13) THEN GOTO CHOSEN1
   IF CURSOR$=CHR$(77) THEN GOTO YES
   IF CURSOR$=CHR$(75) THEN GOTO NO
   GOTO CHOOSE1

NO:
   LOCATE 15,46,0
   PRINT" "
```

```
    LOCATE 15,21,0
    PRINT CHR$(178)
    CHOICE$="N"
    GOTO CHOOSE1

YES:
    LOCATE 15,21,0
    PRINT" "
    LOCATE 15,46,0
    PRINT CHR$(178)
    CHOICE$="Y"
    GOTO CHOOSE1

CHOSEN1:
    IF CHOICE$ = "N" THEN GOTO CHKDSK
    IF CHOICE$ <> "Y" THEN GOTO BEGIN
    COLOR 7,0
    CLS
    SHELL "CD\"
    SYSTEM

CHKDSK:
    IF DSKID$ = "HD" THEN GOTO GOBACK
    OPEN PPATH$ + "DSKID.CHK" FOR INPUT AS #1
    INPUT #1,DSKID$
    CLOSE #1
    IF DSKID$ = DIRECT$ OR DSKID$ = "HD" THEN GOTO GOBACK
    CLS
    LOCATE 12,15,0
    PRINT"Please Place Program Disk 1 in Drive ";PPATH$
    LOCATE 14,15,0
    PRINT"and Press Any Key to Continue"

    CHKCHOOSE:
       SEL$=INKEY$
       IF SEL$="" THEN GOTO CHKCHOOSE
       GOTO CHKDSK

GOBACK:
    CHAIN PPATH$ + LINK$

TRAP:
  SCREEN 2
  SCREEN 0,1,0,0
  COLOR 7,1
  CLS
  PRINT " ";TAB(30);"ERROR INFORMATION"
  COLOR 14,1
  PRINT "═══════════════════════════════════════";
  PRINT "═══════════════════════════════════════"
  DEF SEG=0:POKE 1050,PEEK(1052)
KNOWN:
```

```
   IF ERR < 24 THEN GOTO UNKNOWN
   IF ERR = 26 THEN GOTO UNKNOWN
   IF ERR > 27 AND ERR < 52 THEN GOTO UNKNOWN
   IF ERR > 53 AND ERR < 61 THEN GOTO UNKNOWN
   IF ERR > 61 AND ERR < 68 THEN GOTO UNKNOWN
   IF ERR = 69 THEN GOTO UNKNOWN
   IF ERR > 72 AND ERR < 76 THEN GOTO UNKNOWN
   IF ERR > 76 THEN GOTO UNKNOWN
   LOCATE 8,10,0
   PRINT "AN ERROR HAS OCCURRED DURING THE OPERATION OF THIS PROGRAM:"
   LOCATE 10,5,0
   IF ERR = 24 THEN PRINT "DISK DRIVE OR PRINTER IS NOT TURNED ON";
     IF ERR = 24 THEN PRINT "OR PLUGGED IN"
   IF ERR = 25 THEN PRINT "HARDWARE MALFUNCTION"
   IF ERR = 27 THEN PRINT "THE PRINTER IS OUT OF PAPER"
   IF ERR = 52 THEN PRINT "THE FILE NAME IS INVALID. RENAME THE FILE."
   IF ERR = 61 THEN PRINT "YOU WILL HAVE TO USE A NEW DISK. THIS ONE IS FULL"
   IF ERR = 68 THEN PRINT "TARGET DEVICE DOES NOT EXIST, THIS PROGRAM"
     IF ERR = 68 THEN PRINT "ATTEMPTED TO ACCESS A DISK DRIVE OR PRINTER"
     IF ERR = 68 THEN PRINT "WHICH IS NOT PRESENT. SOFTWARE MUST BE RE-"
     IF ERR = 68 THEN PRINT "CONFIGURED TO PERFORM THE REQUESTED ACTION"
   IF ERR = 70 THEN PRINT "THE DISK IS WRITE PROTECTED"
   IF ERR = 53 OR ERR = 76 THEN PRINT "PROBABLY THE WRONG DISK IS IN";
     IF ERR = 53 OR ERR = 76 THEN PRINT " THE DISK DRIVE."
   IF ERR = 71 THEN PRINT "EITHER THE DISK DRIVE DOOR IS OPEN OR THERE";
     IF ERR = 71 THEN PRINT " IS NO DISK IN THE DRIVE"
   IF ERR = 72 THEN PRINT "THE DISKETTE IS PROBABLY BAD. USE A NEW DISKETTE"
   GOTO PAUSE
UNKNOWN:
   LOCATE 10,5,0
   PRINT "AN ERROR HAS BEEN IDENTIFIED IN THIS PROGRAM. PLEASE CONTACT"
   LOCATE 11,5,0
   PRINT "YOUR SOFTWARE SUPPORT REPRESENTATIVE AND REPORT THAT ERROR"
   LOCATE 12,5,0
   PRINT "NUMBER";ERR;" OCCURRED IN SUB-ROUTINE: ";LINK$
   LOCATE 20,28,0
   COLOR 20
   PRINT "PRESS ANY KEY TO CONTINUE"
   COLOR 14,1
   GOTO SCAN
PAUSE:
   LOCATE 20,15,0
   COLOR 20
   PRINT "CORRECT THIS ERROR AND PRESS ANY KEY TO CONTINUE"
   COLOR 14,1
   CLOSE
SCAN:
   SEL$ = INKEY$
   IF SEL$ = "" THEN GOTO SCAN
   CLS
   RESUME START
```

Subroutine SELECT

```
START:
   DIM A$(24,2)
   DIM A(24,1)
   DIM F$(60)
   DIM B(25)
   DIM MENU$(10)
   DIM RESULT$(10)
   COMMON DSKID$,A$(),A(),F$(),B(),TYPE$,DIRECT$,UNITS$
   COMMON PPMDAYS,INITBIOM,DIR$,SPECNAME$,PERDRY
   COMMON CHEMNAME$,PRNTPLACE$,LINK$,PPATH$,DPATH$
   COMMON MENU$(),MAXITEM,RESULT$(),TITLE$,COUNT,CURBIOM
   LINK$ = "SELECT"
   ON ERROR GOTO TRAP
   SCREEN 0,1,0,0
   COLOR 4,1,6
   IF DSKID$ = "HD" THEN GOTO BEGIN
   OPEN PPATH$ + "DSKID.CHK" FOR INPUT AS #1
   INPUT #1,DSKID$
   CLOSE #1
   IF DSKID$ = "PROG1" THEN GOTO BEGIN
   CLS
   LOCATE 12,15,0
   PRINT"Please Place Program Disk 1 in Drive ";PPATH$
   LOCATE 14,15,0
   PRINT"and Press Any Key to Continue"

WAITING:
   SEL$ = INKEY$
   IF SEL$ = "" THEN GOTO WAITING
   GOTO START

BEGIN:
   COLOR 14,1
   CLS
   LOCATE 12,5,0
   PRINT"          Would You Like to use Metric or U.S. Customary Units?"
   LOCATE 15,5,0
   PRINT"                    Metric                    U.S. Customary"
   LOCATE 22,15,0
   PRINT"MOVE CURSOR TO DESIRED SELECTION AND PRESS <ENTER>"
   LOCATE 23,22,0
   PRINT "(USE ARROW KEYS [";CHR$(24);CHR$(26);CHR$(25);CHR$(27);
   PRINT "] TO MOVE CURSOR)"
   LOCATE 15,21,0
   COLOR 19
   PRINT CHR$(178)
   UNITS$="M"
   DEF SEG=0:POKE 1050,PEEK(1052)

CHOOSE:
```

```
    CURSOR$=INKEY$
    IF CURSOR$="" THEN GOTO CHOOSE
    CURSOR$=RIGHT$(CURSOR$,1)
    IF CURSOR$=CHR$(13) THEN GOTO CHOSEN1
    IF CURSOR$=CHR$(77) THEN GOTO STANDARD
    IF CURSOR$=CHR$(75) THEN GOTO METRIC
    GOTO CHOOSE

METRIC:
    LOCATE 15,46,0
    PRINT" "
    LOCATE 15,21,0
    PRINT CHR$(178)
    UNITS$="M"
    GOTO CHOOSE

STANDARD:
    LOCATE 15,21,0
    PRINT" "
    LOCATE 15,46,0
    PRINT CHR$(178)
    UNITS$="S"
    GOTO CHOOSE

CHOSEN1:
    COLOR 2,8,1
    DEF SEG=0:POKE 1050,PEEK(1052)
    CHAIN PPATH$ + "MENU1"

TRAP:
  SCREEN 2
  SCREEN 0,1,0,0
  COLOR 7,1
  CLS
  PRINT " ";TAB(30);"ERROR INFORMATION"
  COLOR 14,1
  PRINT "═══════════════════════════════════════";
  PRINT "═══════════════════════════════════════"
  DEF SEG=0:POKE 1050,PEEK(1052)
KNOWN:
  IF ERR < 24 THEN GOTO UNKNOWN
  IF ERR = 26 THEN GOTO UNKNOWN
  IF ERR > 27 AND ERR < 52 THEN GOTO UNKNOWN
  IF ERR > 53 AND ERR < 61 THEN GOTO UNKNOWN
  IF ERR > 61 AND ERR < 68 THEN GOTO UNKNOWN
  IF ERR = 69 THEN GOTO UNKNOWN
  IF ERR > 72 AND ERR < 76 THEN GOTO UNKNOWN
  IF ERR > 76 THEN GOTO UNKNOWN
  LOCATE 8,10,0
  PRINT "AN ERROR HAS OCCURRED DURING THE OPERATION OF THIS PROGRAM:"
  LOCATE 10,5,0
  IF ERR = 24 THEN PRINT "DISK DRIVE OR PRINTER IS NOT TURNED ON";
```

```
    IF ERR = 24 THEN PRINT "OR PLUGGED IN"
  IF ERR = 25 THEN PRINT "HARDWARE MALFUNCTION"
  IF ERR = 27 THEN PRINT "THE PRINTER IS OUT OF PAPER"
  IF ERR = 52 THEN PRINT "THE FILE NAME IS INVALID. RENAME THE FILE."
  IF ERR = 61 THEN PRINT "YOU WILL HAVE TO USE A NEW DISK. THIS ONE IS FULL"
  IF ERR = 68 THEN PRINT "TARGET DEVICE DOES NOT EXIST, THIS PROGRAM"
    IF ERR = 68 THEN PRINT "ATTEMPTED TO ACCESS A DISK DRIVE OR PRINTER"
    IF ERR = 68 THEN PRINT "WHICH IS NOT PRESENT. SOFTWARE MUST BE RE-"
    IF ERR = 68 THEN PRINT "CONFIGURED TO PERFORM THE REQUESTED ACTION"
  IF ERR = 70 THEN PRINT "THE DISK IS WRITE PROTECTED"
  IF ERR = 53 OR ERR = 76 THEN PRINT "PROBABLY THE WRONG DISK IS IN";
    IF ERR = 53 OR ERR = 76 THEN PRINT " THE DISK DRIVE."
  IF ERR = 71 THEN PRINT "EITHER THE DISK DRIVE DOOR IS OPEN OR THERE";
    IF ERR = 71 THEN PRINT " IS NO DISK IN THE DRIVE"
  IF ERR = 72 THEN PRINT "THE DISKETTE IS PROBABLY BAD. USE A NEW DISKETTE"
  GOTO PAUSE
UNKNOWN:
  LOCATE 10,5,0
  PRINT "AN ERROR HAS BEEN IDENTIFIED IN THIS PROGRAM. PLEASE CONTACT"
  LOCATE 11,5,0
  PRINT "YOUR SOFTWARE SUPPORT REPRESENTATIVE AND REPORT THAT ERROR"
  LOCATE 12,5,0
  PRINT "NUMBER";ERR;" OCCURRED IN SUB-ROUTINE: ";LINK$
  LOCATE 20,28,0
  COLOR 20
  PRINT "PRESS ANY KEY TO CONTINUE"
  COLOR 14,1
  GOTO SCAN
PAUSE:
  LOCATE 20,15,0
  COLOR 20
  PRINT "CORRECT THIS ERROR AND PRESS ANY KEY TO CONTINUE"
  COLOR 14,1
  CLOSE
SCAN:
  SEL$ = INKEY$
  IF SEL$ = "" THEN GOTO SCAN
  CLS
  RESUME START
```

Subroutine INPUT

```
START:
   DIM A$(24,2)
   DIM A(24,1)
   DIM F$(60)
   DIM B(25)
   DIM MENU$(10)
   DIM RESULT$(10)
   DIM FILESIN$(60)
   COMMON DSKID$,A$(),A(),F$(),B(),TYPE$,DIRECT$,UNITS$
   COMMON PPMDAYS,INITBIOM,DIR$,SPECNAME$,PERDRY
```

```
    COMMON CHEMNAME$,PRNTPLACE$,LINK$,PPATH$,DPATH$
    COMMON MENU$(),MAXITEM,RESULT$(),TITLE$,COUNT,CURBIOM
    LINK$ = "INPUT"
    ON ERROR GOTO TRAP
    SCREEN 0,1,0,0
    IF DSKID$ = "HD" THEN GOTO CHKDATA
    OPEN PPATH$ + "DSKID.CHK" FOR INPUT AS #1
    INPUT #1,DSKID$
    CLOSE #1
    IF DSKID$ = "PROG1" THEN GOTO CHKDATA
    CLS
    LOCATE 12,15,0
    PRINT"Please Place Program Disk 1 in Drive ";PPATH$
    LOCATE 14,15,0
    PRINT"and Press Any Key to Continue"

    CHKCHOOSE:
       SEL$=INKEY$
       IF SEL$="" THEN GOTO CHKCHOOSE
       GOTO START

CHKDATA:
    IF DSKID$ = "HD" THEN GOTO BEGIN
    CLS
    LOCATE 12,15,0
    PRINT"Please Place the Data Disk for ";SPECNAME$;" and "
    LOCATE 14,20,0
    PRINT CHEMNAME$;" in Drive ";DPATH$
    LOCATE 16,20,0
    PRINT"and Press Any Key to Continue"

    SIT:
       SEL$=INKEY$
       IF SEL$="" THEN GOTO SIT

    OPEN DPATH$ + "DSKID.CHK" FOR INPUT AS #1
    INPUT #1,DSKID$
    CLOSE #1
    IF DSKID$ = "DATA" THEN GOTO BEGIN
    GOTO CHKDATA

'=================  LOAD A DISK FILE? ==================

BEGIN:
    COLOR 14,1
    CLS
    LOCATE 12,5,0
    PRINT"              Would You Like to Load a Disk File?"
    LOCATE 15,5,0
    PRINT"                   Yes                        No"
    LOCATE 21,5,0
    PRINT "IF YOU DO NOT LOAD A DISK FILE, THE DEFAULT DATA SET";
```

```
    PRINT " WILL BE LOADED."
    LOCATE 22,15,0
    PRINT "MOVE CURSOR TO DESIRED SELECTION AND PRESS <ENTER>"
    LOCATE 23,22,0
    PRINT "(USE ARROW KEYS [";CHR$(24);CHR$(26);CHR$(25);CHR$(27);
    PRINT "] TO MOVE CURSOR)"
    LOCATE 15,21,0
    COLOR 19
    PRINT CHR$(178)
    CHOICE$="Y"
    DEF SEG=0:POKE 1050,PEEK(1052)

CHOOSE1:
    CURSOR$=INKEY$
    IF CURSOR$="" THEN GOTO CHOOSE1
    CURSOR$=RIGHT$(CURSOR$,1)
    IF CURSOR$=CHR$(13) THEN GOTO CHOSEN1
    IF CURSOR$=CHR$(77) THEN GOTO NO
    IF CURSOR$=CHR$(75) THEN GOTO YES
    GOTO CHOOSE1

YES:
    LOCATE 15,46,0
    PRINT" "
    LOCATE 15,21,0
    PRINT CHR$(178)
    CHOICE$="Y"
    GOTO CHOOSE1

NO:
    LOCATE 15,21,0
    PRINT" "
    LOCATE 15,46,0
    PRINT CHR$(178)
    CHOICE$="N"
    GOTO CHOOSE1

CHOSEN1:
    IF CHOICE$ = "N" THEN GOTO LOADDEF
    IF CHOICE$ <> "Y" THEN GOTO BEGIN

'================== DISK FILE DIRECTORY ==========================

DIR:
  SHELL "DIR " + DPATH$ + DIRECT$ + DIR$ + "\*.* >" + DPATH$ + "FILES.DAT"
  OPEN DPATH$ + "FILES.DAT" FOR INPUT AS #1
  READLOOP:
    FOR I = 1 TO 59
       INPUT #1,TEXTIN$
       IF EOF(1) THEN GOTO KILLFILE
       IF I < 5 THEN GOTO READEND
       IF MID$(TEXTIN$,14,1) = "<" THEN I = I - 1:GOTO READEND
```

```
        FILESIN$(I - 4) = LEFT$(TEXTIN$,13)
  READEND:
    NEXT I
  CLOSE

KILLFILE:
  SHELL "ERASE " + DPATH$ + "FILES.DAT"
  IF I > 59 THEN GOTO OVERFLOW1

PRINTOUT:
   CLOSE
   FILESIN$(I - 4)="<ESCAPE>"
   COLOR 14,1
   CLS
   ROW = 2
   COL = 5
   PRTLIN = 1
   PRTCOL = 5
   LOCATE 24,1,0
   COLOR 14,4
   PRINT" <";DIRECT$;DIR$;">";TAB(30);
   PRINT " MOVE CURSOR TO DESIRED FILE AND PRESS <ENTER>";TAB(80);" ";
   LOCATE 25,1,0
   PRINT "   OR CHOOSE <ESCAPE> AND PRESS <ENTER>";
   PRINT " IF YOU DO NOT WISH TO LOAD A FILE";TAB(80);" ";
   ELEMENT = 0
   COLOR 14,1
PRINTLOOP:
   COLOR 14,1
   FOR K = 1 TO 21
      IF ELEMENT = I - 4 THEN GOTO PUTCURSOR
      PRTLIN = PRTLIN + 1
      IF K < 21 THEN ELEMENT = ELEMENT + 1:GOTO SKIP
      PRTCOL = PRTCOL + 22
      PRTLIN = 1
      GOTO PRINTLOOP
    SKIP:
      IF ELEMENT = I - 4 THEN COLOR 4
      LOCATE PRTLIN,PRTCOL,0
      PRINT FILESIN$(ELEMENT)
      COLOR 14,1
      GOTO NEXTK
NEXTK:
   NEXT K

PUTCURSOR:
   COLOR 14,1
   IF ELEMENT = 0 THEN FILESIN$(1) = "<ESCAPE>"
   IF ELEMENT = 0 THEN ELEMENT = 1
   LOCATE 23,1,0
   PRINT "TOTAL NUMBER OF ITEMS LISTED IS: ";ELEMENT - 1;TAB(80);" ";
   LOCATE ROW,COL,0
```

```
    COLOR 0,11
    PRINT FILESIN$(1)
    DEF SEG=0:POKE 1050,PEEK(1052)

CHOOSE2:
    CURSOR$ = INKEY$
    IF CURSOR$ = "" THEN GOTO CHOOSE2
    IF CURSOR$ = CHR$(13) THEN GOTO CHOICEMADE
    CURSOR$ = RIGHT$(CURSOR$,1)
    IF CURSOR$ = CHR$(75) THEN GOTO BACKARROW
    IF CURSOR$ = CHR$(72) THEN GOTO UPARROW
    IF CURSOR$ = CHR$(77) THEN GOTO FOREARROW
    IF CURSOR$ = CHR$(80) THEN GOTO DOWNARROW
    GOTO CHOOSE2

GETELEMENT:
    IF COL = 5 THEN COLN = 0
    IF COL = 27 THEN COLN = 20
    IF COL = 49 THEN COLN = 40
    FILENUM = (ROW - 1) + COLN
    RETURN

UPARROW:
    CHOICE$ = "UP"
    ROW = ROW - 1
    IF ROW < 2 THEN ROW = 2:GOTO CHOOSE2
    GOSUB GETELEMENT
    IF FILENUM > ELEMENT THEN GOTO STOPHERE
    LOCATE ROW + 1,COL,0
    IF FILESIN$(FILENUM + 1) = "<ESCAPE>" THEN COLOR 4,1 ELSE COLOR 14,1
    PRINT FILESIN$(FILENUM + 1)
    COLOR 0,11
    LOCATE ROW,COL,0
    PRINT FILESIN$(FILENUM)
    GOTO CHOOSE2

DOWNARROW:
    CHOICE$ = "DOWN"
    ROW = ROW + 1
    IF ROW > 21 THEN ROW = 21:GOTO CHOOSE2
    GOSUB GETELEMENT
    IF FILENUM > ELEMENT THEN GOTO STOPHERE
    LOCATE ROW - 1,COL,0
    IF FILESIN$(FILENUM - 1) = "<ESCAPE>" THEN COLOR 4,1 ELSE COLOR 14,1
    PRINT FILESIN$(FILENUM - 1)
    COLOR 0,11
    LOCATE ROW,COL,0
    PRINT FILESIN$(FILENUM)
    GOTO CHOOSE2

FOREARROW:
    CHOICE$ = "RIGHT"
```

```
    COL = COL + 22
    IF COL > 49 THEN COL = 49:GOTO CHOOSE2
    GOSUB GETELEMENT
    IF FILENUM > ELEMENT THEN GOTO STOPHERE
    LOCATE ROW,COL-22,0
    IF FILESIN$(FILENUM - 20) = "<ESCAPE>" THEN COLOR 4,1 ELSE COLOR 14,1
    PRINT FILESIN$(FILENUM - 20)
    COLOR 0,11
    LOCATE ROW,COL,0
    PRINT FILESIN$(FILENUM)
    GOTO CHOOSE2

BACKARROW:
    CHOICE$ = "LEFT"
    COL = COL - 22
    IF COL < 5 THEN COL = 5:GOTO CHOOSE2
    GOSUB GETELEMENT
    IF FILENUM > ELEMENT THEN GOTO STOPHERE
    LOCATE ROW,COL+22,0
    IF FILESIN$(FILENUM + 20) = "<ESCAPE>" THEN COLOR 4,1 ELSE COLOR 14,1
    PRINT FILESIN$(FILENUM + 20)
    COLOR 0,11
    LOCATE ROW,COL,0
    PRINT FILESIN$(FILENUM)
    GOTO CHOOSE2

STOPHERE:
    COLOR 14,1
    IF CHOICE$ = "UP" THEN LOCATE ROW + 1,COL,0:COL = 5:ROW = 2
    IF CHOICE$ = "UP" THEN PRINT FILESIN$(FILENUM + 1):GOTO PUTCURSOR
    IF CHOICE$ = "DOWN" THEN COLOR 4,1
    IF CHOICE$ = "DOWN" THEN LOCATE ROW - 1,COL,0:COL = 5:ROW = 2
    IF CHOICE$ = "DOWN" THEN PRINT FILESIN$(FILENUM - 1):GOTO PUTCURSOR
    IF CHOICE$ = "RIGHT" AND FILESIN$(FILENUM - 20) = "<ESCAPE>" THEN COLOR 4,1
    IF CHOICE$ = "RIGHT" THEN LOCATE ROW,COL-22,0:COL = 5:ROW = 2
    IF CHOICE$ = "RIGHT" THEN PRINT FILESIN$(FILENUM - 20):GOTO PUTCURSOR
    IF CHOICE$ = "LEFT" THEN LOCATE ROW,COL+22,0:COL = 5:ROW = 2
    IF CHOICE$ = "LEFT" THEN PRINT FILESIN$(FILENUM + 20):GOTO PUTCURSOR

CHOICEMADE:
    GOSUB GETELEMENT
    IF FILESIN$(1) = "<ESCAPE>" THEN GOTO BEGIN
    IF FILENUM > ELEMENT THEN GOTO CHOOSE2
    FILE$ = FILESIN$(FILENUM)
    IF FILE$ = "<ESCAPE>" THEN GOTO BEGIN
    GOTO CHOSEN

OVERFLOW1:
    COLOR 2,8,1
    CLS
    PRINT"THERE ARE TOO MANY FILES FOR THIS ROUTINE."
    PRINT"TO SELECT YOUR FILE, YOU MUST ENTER THE NAME"
```

```
    PRINT"OF THE FILE BELOW (INCLUDING EXTENSION):"
    PRINT:PRINT:INPUT"ENTER FILE NAME===> ";FILE$

CHOSEN:
    COLOR 14,1
    CLS
    LOCATE 12,1,0
    PRINT " ";TAB(80);" ";
    LOCATE 12,1,0
    FILE$ = LEFT$(FILE$,8) + ".DAT"
    PRINT "    FILE SELECTED IS: ";FILE$;TAB(80);" ";
    PRINT "       IF THIS IS CORRECT, PRESS <ENTER>.";
    PRINT " OTHERWISE, ENTER A SLASH ( / )";TAB(80);" ";
    PRINT"      AND THEN PRESS <ENTER>.";TAB(80);" "
    DEF SEG=0:POKE 1050,PEEK(1052)

CHOOSE3:
    SEL$ = INKEY$
    IF SEL$ = "" THEN GOTO CHOOSE3
    SEL = ASC(SEL$)
    IF SEL = 47 GOTO PRINTOUT
    OPEN DPATH$ + DIRECT$ + DIR$ + "\" + FILE$ FOR INPUT AS #1
    INPUT #1,CHECK$,CHECK2$
    CLOSE
    IF CHECK2$=UNITS$ THEN GOTO LOADFILE ELSE BEEP
    IF UNITS$="M" THEN UNICHK$="Metric" ELSE UNICHK$="U.S. Customary"
    CLS
    LOCATE 10,1,0
    PRINT"The file does not contain the correct type of data for input."
    PRINT"Check the directory to make sure you";
    PRINT" are requesting the proper data file"
    PRINT"for input in ";UNICHK$;" units."
    DEF SEG=0:POKE 1050,PEEK(1052)
    PRINT
    INPUT"PRESS <ENTER> TO CONTINUE";X$
    CLOSE #1
    GOTO BEGIN

LOADFILE:
    OPEN DPATH$ + DIRECT$ + DIR$ + "\" + FILE$ FOR INPUT AS #1
    FOR I=0 TO 24
    INPUT #1,A(I,0),A(I,1)
    NEXT I
    CLOSE #1
    CLS
    LOCATE 12,3,0
    PRINT
    PRINT"    FILE ";FILE$;" HAS BEEN LOADED. PRESS ANY KEY TO CONTINUE"
    DEF SEG=0:POKE 1050,PEEK(1052)

WAITING2:
  SEL$=INKEY$
```

```
  IF SEL$="" THEN GOTO WAITING2
  TITLE$ = "                          Change / Save / Review Menu"
  MENU$(1) = "1. Continue Program (Fate Calculations)"
  MENU$(2) = "2. Save Data to Disk"
  MENU$(3) = "3. Change / Review Data"
  MENU$(4) = "4. Help and Instructions"
  MENU$(5) = "5. Exit HERBICIDE Program"
  RESULT$(1) = "CALC"
  RESULT$(2) = "SAVE"
  RESULT$(3) = "ENTER"
  RESULT$(4) = "HELP1"
  RESULT$(5) = "QUIT"
  MAXITEM = 5
  CHAIN PPATH$ + "MENU"

LOADDEF:
   DEFAULT$ = DPATH$ + DIRECT$ + DIR$ + "\DEFAULT\" + UNITS$ + ".DEF"
   OPEN DEFAULT$ FOR INPUT AS #1
   FOR I=0 TO 24
   INPUT #1,A(I,0),A(I,1)
   NEXT I
   CLOSE #1
   CHAIN PPATH$ + "ENTER"

TRAP:
  SCREEN 2
  SCREEN 0,1,0,0
  COLOR 7,1
  CLS
  PRINT " ";TAB(30);"ERROR INFORMATION"
  COLOR 14,1
  PRINT "═══════════════════════════════════════";
  PRINT "═══════════════════════════════════════"
  DEF SEG=0:POKE 1050,PEEK(1052)
KNOWN:
  IF ERR < 24 THEN GOTO UNKNOWN
  IF ERR = 26 THEN GOTO UNKNOWN
  IF ERR > 27 AND ERR < 52 THEN GOTO UNKNOWN
  IF ERR > 53 AND ERR < 61 THEN GOTO UNKNOWN
  IF ERR > 61 AND ERR < 68 THEN GOTO UNKNOWN
  IF ERR = 69 THEN GOTO UNKNOWN
  IF ERR > 72 AND ERR < 76 THEN GOTO UNKNOWN
  IF ERR > 76 THEN GOTO UNKNOWN
  LOCATE 8,10,0
  PRINT "AN ERROR HAS OCCURRED DURING THE OPERATION OF THIS PROGRAM:"
  LOCATE 10,5,0
  IF ERR = 24 THEN PRINT "DISK DRIVE OR PRINTER IS NOT TURNED ON";
    IF ERR = 24 THEN PRINT "OR PLUGGED IN"
  IF ERR = 25 THEN PRINT "HARDWARE MALFUNCTION"
  IF ERR = 27 THEN PRINT "THE PRINTER IS OUT OF PAPER"
  IF ERR = 52 THEN PRINT "THE FILE NAME IS INVALID. RENAME THE FILE."
  IF ERR = 61 THEN PRINT "YOU WILL HAVE TO USE A NEW DISK. THIS ONE IS FULL"
```

```
  IF ERR = 68 THEN PRINT "TARGET DEVICE DOES NOT EXIST, THIS PROGRAM"
    IF ERR = 68 THEN PRINT "ATTEMPTED TO ACCESS A DISK DRIVE OR PRINTER"
    IF ERR = 68 THEN PRINT "WHICH IS NOT PRESENT. SOFTWARE MUST BE RE-"
    IF ERR = 68 THEN PRINT "CONFIGURED TO PERFORM THE REQUESTED ACTION"
  IF ERR = 70 THEN PRINT "THE DISK IS WRITE PROTECTED"
  IF ERR = 53 OR ERR = 76 THEN PRINT "PROBABLY THE WRONG DISK IS IN";
    IF ERR = 53 OR ERR = 76 THEN PRINT " THE DISK DRIVE."
  IF ERR = 71 THEN PRINT "EITHER THE DISK DRIVE DOOR IS OPEN OR THERE";
    IF ERR = 71 THEN PRINT " IS NO DISK IN THE DRIVE"
  IF ERR = 72 THEN PRINT "THE DISKETTE IS PROBABLY BAD. USE A NEW DISKETTE"
  GOTO PAUSE
UNKNOWN:
  LOCATE 10,5,0
  PRINT "AN ERROR HAS BEEN IDENTIFIED IN THIS PROGRAM. PLEASE CONTACT"
  LOCATE 11,5,0
  PRINT "YOUR SOFTWARE SUPPORT REPRESENTATIVE AND REPORT THAT ERROR"
  LOCATE 12,5,0
  PRINT "NUMBER";ERR;" OCCURRED IN SUB-ROUTINE: ";LINK$
  LOCATE 20,28,0
  COLOR 20
  PRINT "PRESS ANY KEY TO CONTINUE"
  COLOR 14,1
  GOTO SCAN
PAUSE:
  LOCATE 20,15,0
  COLOR 20
  PRINT "CORRECT THIS ERROR AND PRESS ANY KEY TO CONTINUE"
  COLOR 14,1
  CLOSE
SCAN:
  SEL$ = INKEY$
  IF SEL$ = "" THEN GOTO SCAN
  CLS
  RESUME START
```

Subroutine ENTER

```
BEGIN:
   DIM A$(24,2)
   DIM A(24,1)
   DIM F$(60)
   DIM B(25)
   DIM MENU$(10)
   DIM RESULT$(10)
   DIM HOLD(24,1)
   COMMON DSKID$,A$(),A(),F$(),B(),TYPE$,DIRECT$,UNITS$
   COMMON PPMDAYS,INITBIOM,DIR$,SPECNAME$,PERDRY
   COMMON CHEMNAME$,PRNTPLACE$,LINK$,PPATH$,DPATH$
   COMMON MENU$(),MAXITEM,RESULT$(),TITLE$,COUNT,CURBIOM
   MAXITEMS = 24
   KEY(1) ON
   ON KEY(1) GOSUB QUIT
```

```
    LINK$ = "ENTER"
    ON ERROR GOTO TRAP
    SCREEN 0,1,0,0
    IF DSKID$ = "HD" THEN GOTO START
    OPEN PPATH$ + "DSKID.CHK" FOR INPUT AS #1
    INPUT #1,DSKID$
    CLOSE #1
    IF DSKID$ = "PROG1" THEN GOTO START
    CLS
    LOCATE 12,15,0
    PRINT"Please Place Program Disk 1 in Drive ";PPATH$
    LOCATE 14,15,0
    PRINT"and Press Any Key to Continue"

CHKCHOOSE:
    SEL$=INKEY$
    IF SEL$="" THEN GOTO CHKCHOOSE
    GOTO START

START:
    FOR I = 0 TO MAXITEMS
      HOLD(I,0) = A(I,0)
      HOLD(I,1) = A(I,1)
    NEXT I
    IF UNITS$ = "S" THEN GOTO STANDARD

METRIC:
  A$(1,0)="Average Depth of area to be Treated (meters)"
  A$(1,1)="(Used to calculate water volume)"
  A$(1,2)="(This may have any positive value)"
  A$(2,0)="Water Flow Rate From Treated Area (meters/min.)"
  A$(2,1)="(Used to calculate herbicide dispersal so, if a very large"
  A$(2,2)="fraction of the lake is treated, dispersal is unimportant, enter 0)"
  A$(3,0)="Total Suspended Solids in Water (mg/l)"
  A$(3,1)="(used to determine loss of herbicide due to sorption)"
  A$(3,2)="(a clear system may be 1 mg/l and a muddy one 20-50 mg/l)"
  A$(4,0)="Depth of Active Sediment Layer (cm)"
  A$(4,1)="(the portion of the sediment which is 'well mixed')"
  A$(4,2)="(This value is used to determine loss of herbicide to sediments)"
  A$(5,0)="Sediment Water Content (%)"
  A$(5,1)="(water content of the 'active' sediment layer)"
  A$(5,2)="(used to calculate actual mass of solids in the sediments)"
  A$(6,0)="Sediment Diffusion Exchange Rate (cm/day)"
  A$(6,1)="(rate at which interstitial water moves in sediment. Used to"
  A$(6,2)="determine the rate at which dissolved herbicide enters sediments)"
  A$(7,0)="Sedimentation Rate (cm/Year)"
  A$(7,1)="(used to calculate loss of herbicide due to sorption and"
  A$(7,2)="addition of herbicide to sediments)"
  A$(8,0)="Sediment Resuspension Rate (cm/Year)"
  A$(8,1)="(for calculating rate of herbicide return to suspended"
  A$(8,2)="solids in water from sediments)"
  A$(9,0)="Herbicide Formulation Release Halflife (days)"
```

```
  A$(9,1)="(the time it takes 1/2 to dissolve in water)"
  A$(9,2)="(this is zero for liquid formulations)"
  A$(10,0)="Active Ingredient Fraction of Herbicide (kg/liter)"
  A$(10,1)="(this can be obtained from the herbicide label)"
  A$(10,2)="(NOTE: this value is for the PURE COMPOUND not the formulation"
  A$(11,0)="Application Rate of Formulation (liters/hectare)"
  A$(11,1)="(weight of herbicide FORMULATION applied per hectare)"
  A$(11,2)="(this can be obtained from the herbicide label)"
  A$(12,0)="Loss of Herbicide Due to Drift (%)"
  A$(12,1)="(due to wind drift from area, etc.)"
  A$(12,2)=""
  A$(13,0)="Herbicide Sediment Layer Partition Coefficient"
  A$(13,1)="(the ratio of sed. conc./water conc. at equilibrium)"
  A$(13,2)="(this determines how much is lost due to sorption)"
  A$(14,0)="Herbicide Hydrolysis Halflife in Water (days)"
  A$(14,1)="(the time it takes 1/2 to hydrolyze in water)"
  A$(14,2)="(if this is not an important fate process, use a value of 1000)"
  A$(15,0)="Herbicide Hydrolysis Halflife in Sediment (days)"
  A$(15,1)="(the time it takes 1/2 to hydrolyze in sediment)"
  A$(15,2)="(if this is not an important fate process, use a value of 1000)"
  A$(16,0)="Herbicide Oxidation Halflife in Water (days)"
  A$(16,1)="(the time it takes 1/2 to Oxidize in water)"
  A$(16,2)="(if this is not an important fate process, use a value of 1000)"
  A$(17,0)="Herbicide Oxidation Halflife in Sediment (days)"
  A$(17,1)="(the time it takes 1/2 to Oxidize in sediment)"
  A$(17,2)="(if this is not an important fate process, use a value of 1000)"
  A$(18,0)="Herbicide Biotransformation Halflife in Water (days)"
  A$(18,1)="(the time it takes 1/2 to biotransform in water)"
  A$(18,2)="(if this is not an important fate process, use a value of 1000)"
  A$(19,0)="Herbicide Biotransformation Halflife in Sediment (days)
  A$(19,1)="(the time it takes 1/2 to biotransform in sediment)"
  A$(19,2)="(if this is not an important fate process, use a value of 1000)"
  A$(20,0)="Herbicide Photolysis Halflife in Water (days)"
  A$(20,1)="(the time it takes 1/2 to photolyze in water)"
  A$(20,2)="(if this is not an important fate process, use a value of 1000)"
  A$(21,0)="Herbicide Volatilization Halflife in Water (days)"
  A$(21,1)="(the time it takes 1/2 to volatilize in water)"
  A$(21,2)="(if this is not an important fate process, use a value of 1000)"
  IF TYPE$ <> "FLOATING" THEN GOTO NOTFLOAT1
  A$(22,0)="Percent Herbicide Interception at this Plant Density"
  A$(22,1)="(the amount of the spray that remains on the plant leaves)"
  A$(22,2)="(this value is calculated by the program but may be changed)"
  GOTO CONTVALS1

NOTFLOAT1:
  A$(22,0)="Bioconcentration Factor of Herbicide for this Plant Species"
  A$(22,1)="(the ratio of plant tissue conc./water conc. at equilibrium)"
  A$(22,2)="(this value may range from just above 0 to several hundred)"

CONTVALS1:
  A$(23,0)="Plant Biomass to be Treated (metric tons/hectare)"
  A$(23,1)="(the amount (wet weight) of plants to be treated per hectare)"
```

```
  A$(23,2)="(this should be an average of the biomass in all areas)"
  A$(24,0)="Percent Dry Weight of Plant Tissue (%)"
  A$(24,1)="(the percentage of plant tissue which is not water)"
  A$(24,2)=""
  IF A(22,1) = 1 THEN GOTO SETUP
  GOSUB CALCINTERCEP
  GOTO SETUP

STANDARD:
  A$(1,0)="Average Depth of area to be Treated (feet)"
  A$(1,1)="(Used to calculate water volume)"
  A$(1,2)="(This may have any positive value up to 5,000)"
  A$(2,0)="Water Flow Rate From Treated Area (feet/min.)"
  A$(2,1)="(Used to calculate herbicide dispersal so, if a very large"
  A$(2,2)="fraction of the lake is treated, dispersal is unimportant, enter 0)"
  A$(3,0)="Total Suspended Solids in Water (parts per million)"
  A$(3,1)="(used to determine loss of herbicide due to sorption)"
  A$(3,2)="(a clear system may be 1 ppm and a muddy one 20-50 ppm)"
  A$(4,0)="Depth of Active Sediment Layer (inches)"
  A$(4,1)="(the portion of the sediment which is 'well mixed')"
  A$(4,2)="(This value is used to determine loss of herbicide to sediments)"
  A$(5,0)="Sediment Water Content (%)"
  A$(5,1)="(water content of the 'active' sediment layer)"
  A$(5,2)="(used to calculate actual mass of solids in the sediments)"
  A$(6,0)="Sediment Diffusion Exchange Rate (inches/day)"
  A$(6,1)="(rate at which interstitial water moves in sediment. Used to"
  A$(6,2)="determine the rate at which dissolved herbicide enters sediments)"
  A$(7,0)="Sedimentation Rate (inches/Year)"
  A$(7,1)="(used to calculate loss of herbicide due to sorption and"
  A$(7,2)="addition of herbicide to sediments)"
  A$(8,0)="Sediment Resuspension Rate (inches/Year)"
  A$(8,1)="(for calculating rate of herbicide return to suspended"
  A$(8,2)="solids in water from sediments)"
  A$(9,0)="Herbicide Formulation Release Halflife (days)"
  A$(9,1)="(the time it takes 1/2 to dissolve in water)"
  A$(9,2)="(this is zero for liquid formulations)"
  A$(10,0)="Active Ingredient Fraction of Herbicide (lbs/gallon)"
  A$(10,1)="(this can be obtained from the herbicide label)"
  A$(10,2)="(NOTE: this value is for the PURE COMPOUND not the formulation"
  A$(11,0)="Application Rate of Formulation (gallons/acre)"
  A$(11,1)="(weight of herbicide FORMULATION applied per acre)"
  A$(11,2)="(this can be obtained from the herbicide label)"
  A$(12,0)="Loss of Herbicide Due to Drift (%)"
  A$(12,1)="(due to wind drift from area, etc.)"
  A$(12,2)=""
  A$(13,0)="Herbicide Sediment Layer Partition Coefficient [KP]"
  A$(13,1)="(the ratio of sed. conc./water conc. at equilibrium)"
  A$(13,2)="(this determines how much is lost due to sorption)"
  A$(14,0)="Herbicide Hydrolysis Halflife in Water (days)"
  A$(14,1)="(the time it takes 1/2 to hydrolyze in water)"
  A$(14,2)="(if this is not an important fate process, use a value of 1000)"
  A$(15,0)="Herbicide Hydrolysis Halflife in Sediment (days)"
```

```
    A$(15,1)="(the time it takes 1/2 to hydrolyze in sediment)"
    A$(15,2)="(if this is not an important fate process, use a value of 1000)"
    A$(16,0)="Herbicide Oxidation Halflife in Water (days)"
    A$(16,1)="(the time it takes 1/2 to Oxidize in water)"
    A$(16,2)="(if this is not an important fate process, use a value of 1000)"
    A$(17,0)="Herbicide Oxidation Halflife in Sediment (days)"
    A$(17,1)="(the time it takes 1/2 to Oxidize in sediment)"
    A$(17,2)="(if this is not an important fate process, use a value of 1000)"
    A$(18,0)="Herbicide Biotransformation Halflife in Water (days)"
    A$(18,1)="(the time it takes 1/2 to biotransform in water)"
    A$(18,2)="(if this is not an important fate process, use a value of 1000)"
    A$(19,0)="Herbicide Biotransformation Halflife in Sediment (days)
    A$(19,1)="(the time it takes 1/2 to biotransform in sediment)"
    A$(19,2)="(if this is not an important fate process, use a value of 1000)"
    A$(20,0)="Herbicide Photolysis Halflife in Water (days)"
    A$(20,1)="(the time it takes 1/2 to photolyze in water)"
    A$(20,2)="(if this is not an important fate process, use a value of 1000)"
    A$(21,0)="Herbicide Volatilization Halflife in Water (days)"
    A$(21,1)="(the time it takes 1/2 to volatilize in water)"
    A$(21,2)="(if this is not an important fate process, use a value of 1000)"
    IF TYPE$ <> "FLOATING" THEN GOTO NOTFLOAT2
    A$(22,0)="Percent Herbicide Interception at this Plant Density"
    A$(22,1)="(the amount of the spray that remains on the plant leaves)"
    A$(22,2)="(this value is calculated by the program but may be changed)"
    GOTO CONTVALS2

 NOTFLOAT2:
    A$(22,0)="Bioconcentration Factor of Herbicide for this Plant Species"
    A$(22,1)="(the ratio of plant tissue conc./water conc. at equilibrium)"
    A$(22,2)="(this value may range from just above 0 to several hundred)"

 CONTVALS2:
    A$(23,0)="Plant Biomass to be Treated (tons/acre)"
    A$(23,1)="(the amount (wet weight) of plants to be treated per acre)"
    A$(23,2)="(this should be an average of the biomass in all areas)"
    A$(24,0)="Percent Dry Weight of Plant Tissue (%)"
    A$(24,1)="(the percentage of plant tissue which is not water)"
    A$(24,2)=""
    IF A(22,1) = 1 THEN GOTO SETUP
    GOSUB CALCINTERCEP
    GOTO SETUP

CALCINTERCEP:
    IF TYPE$ <> "FLOATING" THEN RETURN
    IF A(23,0) <= 0 THEN A(23,0) = 0.00001
    BIOMASS = A(23,0)
    IF UNITS$ = "S" THEN GOTO CUSTREG
    INTERCEPT = (BIOMASS * 0.1908) + 0.4166
    GOTO TRIM
CUSTREG:
    INTERCEPT = (BIOMASS * 0.4279) + 0.4167
TRIM:
```

```
    IF INTERCEPT > 100.000 THEN INTERCEPT = 100.000
    IF INTERCEPT < 0.000 THEN INTERCEPT = 0.000
    INTERCEPT = INTERCEPT * 1000
    INTERCEPT = INT(INTERCEPT)
    INTERCEPT = INTERCEPT / 1000
    A(22,0) = INTERCEPT
    A(22,1) = 0
    HOLD(22,0) = INTERCEPT
    HOLD(22,1) = 0
    RETURN

SETUP:
   FIRSTLINE = 1
   CURLINE = 2
   CURCOL = 1
   WORKPAGE = 1
   DISPAGE = 0
   COLOR 14,1
   SCREEN 0,1,DISPAGE,DISPAGE
   CLS
   LOCATE 12,25,0
   PRINT"INITIALIZING, PLEASE WAIT"
   GOSUB INITSCREEN
   GOTO CHOOSE

INITSCREEN:
   CHARLINE = 1
   SCREEN 0,1,WORKPAGE,DISPAGE
   COLOR 14,1
   CLS
   FOR I = FIRSTLINE TO FIRSTLINE + 5
      COLOR 14,1
      LOCATE CHARLINE,12,0
      PRINT A$(I,0);TAB(80);" ";
      LOCATE CHARLINE+1,12,0
      PRINT A$(I,1);TAB(80);" ";
      LOCATE CHARLINE+2,12,0
      PRINT A$(I,2);TAB(80);" ";
      LOCATE CHARLINE+3,12,0
      PRINT " ";TAB(80);" ";
      COLOR 4,3
      LOCATE CHARLINE,1,0
      PRINT "  VALUE:  "
      COLOR 0,3
      LOCATE CHARLINE+1,1,0
      PRINT USING "#####.###";A(I,0);
      PRINT " ";
      COLOR 4,3
      LOCATE CHARLINE+2,1,0
      IF A(I,1) = 0 THEN PRINT "<default> "
      IF A(I,1) = 1 THEN PRINT "  <user>  "
      CHARLINE = CHARLINE + 4
```

```
    NEXT I
    COLOR 14,4
    LOCATE 24,1,0
    PRINT "       ENTER VALUE, PRESS <ESC> TO RESTORE OLD VALUE OR PRESS";
    PRINT " <F1> TO EXIT";TAB(80);" ";
    LOCATE 25,1,0
    PRINT "  USE ARROW KEYS, PgUp, PgDn. THERE ARE";
    PRINT " MORE VALUES THAN SHOWN ON THIS SCREEN";TAB(80);" ";
    LOCATE CURLINE,CURCOL,0
    COLOR 30,3
    PRINT CHR$(95)
SWAPSCRN:
     IF DISPAGE = 1 THEN DISPAGE = 0:GOTO NEXTPAGE
     DISPAGE = 1
   NEXTPAGE:
     IF DISPAGE = 1 THEN WORKPAGE = 0:GOTO UPDATE
     WORKPAGE = 1
   UPDATE:
     SCREEN 0,1,WORKPAGE,DISPAGE
RETURN

CHOOSE:
  DEF SEG = 0:POKE 1050,PEEK(1052)
SCAN:
   SEL$ = INKEY$
PASS:
   IF SEL$ = "" THEN GOTO SCAN
   TEMPBIO = A(23,0)
   IF SEL$ = "H" OR SEL$ = "I" OR SEL$ = "K" THEN GOTO SCAN
   IF SEL$ = "M" OR SEL$ = "P" OR SEL$ = "Q" THEN GOTO SCAN
   SEL = ASC(RIGHT$(SEL$,1))
   IF SEL = 80 OR SEL = 13 THEN GOTO DOWN
   IF SEL = 81 THEN GOTO PAGEDOWN
   IF SEL = 72 THEN GOTO UP
   IF SEL = 73 THEN GOTO PAGEUP
   IF SEL = 75 OR SEL = 77 OR SEL = 8 OR SEL = 32 THEN GOTO EDITVALUE
   IF SEL = 27 OR SEL = 46 OR (SEL > 47 AND SEL < 58) THEN GOTO EDITVALUE
   GOTO SCAN

'============================ DOWN ============================'

DOWN:
   CURCOL = 1
   SCREEN 0,1,DISPAGE,DISPAGE
   COLOR 14,4
   LOCATE 25,1,0
   PRINT TAB(26);"PROCESSING, PLEASE WAIT";TAB(80);" ";
   GOSUB NEWNUMBER
   DEF SEG = 0:POKE 1050,PEEK(1052)
   IF CURLINE = 22 THEN GOTO PAGEDOWN
   GOTO REFRESHDOWN
```

```
REFRESHDOWN:
   COLOR 4,3
   LOCATE CURLINE,CURCOL,0
   PRINT CHR$(32)
   CURLINE = CURLINE + 4
   LOCATE CURLINE,CURCOL,0
   COLOR 30,3
   PRINT CHR$(95)
   LOCATE 24,1,0
   COLOR 14,4
   PRINT "      ENTER VALUE, PRESS <ESC> TO RESTORE OLD VALUE OR PRESS";
   PRINT " <F1> TO EXIT";TAB(80);" ";
   LOCATE 25,1,0
   PRINT "  USE ARROW KEYS, PgUp, PgDn. THERE ARE";
   PRINT " MORE VALUES THAN SHOWN ON THIS SCREEN";TAB(80);" ";
   CURCOL = 1
   GOTO SCAN

PAGEDOWN:
   SCREEN 0,1,DISPAGE,DISPAGE
   GOSUB MOVEMESSAGE
   GOSUB NEWNUMBER
   IF FIRSTLINE = MAXITEMS - 5 THEN GOSUB BOTTOM:GOTO SCAN
   FIRSTLINE = FIRSTLINE + 6
   IF FIRSTLINE > MAXITEMS - 5 THEN FIRSTLINE = MAXITEMS - 5
   CURLINE = 2
   CURCOL = 1
   GOSUB INITSCREEN
   GOTO CHOOSE

BOTTOM:
   SCREEN 0,1,DISPAGE,DISPAGE
   COLOR 14,4
   LOCATE 25,1,0
   PRINT TAB(30);"BOTTOM OF INPUT FACILITY";TAB(80);" ";
   COLOR 4,3
   LOCATE CURLINE,CURCOL,0
   PRINT CHR$(32)
   CURLINE = 22
   LOCATE CURLINE,CURCOL,0
   COLOR 30,3
   PRINT CHR$(95)
   DEF SEG = 0:POKE 1050,PEEK(1052)
   RETURN

'============================== UP ==============================

UP:
   CURCOL = 1
   SCREEN 0,1,DISPAGE,DISPAGE
   COLOR 14,4
   LOCATE 25,1,0
```

```
    PRINT TAB(26);"PROCESSING, PLEASE WAIT";TAB(80);" ";
    GOSUB NEWNUMBER
    DEF SEG = 0:POKE 1050,PEEK(1052)
    IF CURLINE = 2 THEN GOTO PAGEUP
    GOTO REFRESHUP

REFRESHUP:
    COLOR 4,3
    LOCATE CURLINE,CURCOL,0
    PRINT CHR$(32)
    CURLINE = CURLINE - 4
    LOCATE CURLINE,CURCOL,0
    COLOR 30,3
    PRINT CHR$(95)
    LOCATE 24,1,0
    COLOR 14,4
    PRINT "      ENTER VALUE, PRESS <ESC> TO RESTORE OLD VALUE OR PRESS";
    PRINT " <F1> TO EXIT";TAB(80);" ";
    LOCATE 25,1,0
    PRINT "  USE ARROW KEYS, PgUp, PgDn. THERE ARE";
    PRINT " MORE VALUES THAN SHOWN ON THIS SCREEN";TAB(80);" ";
    CURCOL = 1
    GOTO SCAN

PAGEUP:
    SCREEN 0,1,DISPAGE,DISPAGE
    GOSUB MOVEMESSAGE
    GOSUB NEWNUMBER
    IF FIRSTLINE = 1 THEN GOSUB TOP:GOTO SCAN
    FIRSTLINE = FIRSTLINE - 6
    IF FIRSTLINE < 1 THEN FIRSTLINE = 1
    CURLINE = 22
    CURCOL = 1
    GOSUB INITSCREEN
    GOTO CHOOSE

TOP:
    SCREEN 0,1,DISPAGE,DISPAGE
    COLOR 14,4
    LOCATE 25,1,0
    PRINT TAB(30);"TOP OF INPUT FACILITY";TAB(80);" ";
    COLOR 4,3
    LOCATE CURLINE,CURCOL,0
    PRINT CHR$(32)
    CURLINE = 2
    LOCATE CURLINE,CURCOL,0
    COLOR 30,3
    PRINT CHR$(95)
    DEF SEG = 0:POKE 1050,PEEK(1052)
    RETURN

MOVEMESSAGE:
```

```
    COLOR 14,4
    LOCATE 25,1,0
    PRINT TAB(30);"MOVING, PLEASE WAIT";TAB(80);" ";
    DEF SEG = 0:POKE 1050,PEEK(1052)
    RETURN

NEWNUMBER:
    B$ = ""
    C$ = ""
    SUBSCRPT = FIRSTLINE + ((CURLINE-2)/4)
    FOR J = 1 TO 10
      TEMP$ = CHR$(SCREEN(CURLINE,J))
      IF TEMP$ = "_" THEN TEMP$ = " "
      B$ = B$ + TEMP$
    NEXT J
    FOR K = 1 TO LEN(B$)
      IF ASC(MID$(B$,K,1)) <> 32 THEN GOTO NOTBLANK
    NEXT K
    GOTO BLANK

NOTBLANK:
    FOR I = K TO LEN(B$)
      IF ASC(MID$(B$,I,1)) <> 32 THEN C$ = C$ + MID$(B$,I,1) ELSE GOTO CLEAN
    NEXT I
CLEAN:
    B = VAL(C$)
    IF B > 9999.99 THEN GOTO OVERFLOW
    IF TYPE$ = "FLOATING" AND SUBSCRPT = 22 AND B > 100 THEN B = 100
    IF B <> A(SUBSCRPT,0) THEN A(SUBSCRPT,1) = 1
    A(SUBSCRPT,0) = B

BLANK:
    COLOR 4,3
    LOCATE CURLINE-1,1,0
    PRINT "  VALUE:  "
    COLOR 0,3
    LOCATE CURLINE,1,0
    PRINT USING "#####.###";A(SUBSCRPT,0);
    PRINT " ";
    IF SUBSCRPT <> 23 OR TYPE$ <> "FLOATING" THEN GOTO SKIPINTERCEP
    IF A(23,0) = TEMPBIO AND SEL <> 27 THEN GOTO SKIPINTERCEP
    GOSUB CALCINTERCEP
    LOCATE CURLINE - 4,1,0
    PRINT USING "#####.###";A(22,0)
    PRINT " ";
    COLOR 4,3
    LOCATE CURLINE - 3,1,0
    PRINT "<default> "
SKIPINTERCEP:
    COLOR 4,3
    LOCATE CURLINE+1,1,0
    IF A(SUBSCRPT,1) = 0 THEN PRINT "<default> "
```

```
    IF A(SUBSCRPT,1) = 1 THEN PRINT "  <user>  "
RETURN

'============================== EDIT ==============================

EDITVALUE:
    SCREEN 0,1,DISPAGE,DISPAGE
    COLOR 4,3
    SUBSCRPT = FIRSTLINE + ((CURLINE-2)/4)
    LOCATE CURLINE-1,1,0
    PRINT USING "#####.###";A(SUBSCRPT,0);
    LOCATE CURLINE,1,0
    PRINT "           "
    LOCATE 24,1,0
    COLOR 14,4
    PRINT "      ENTER VALUE, PRESS <ESC> TO RESTORE OLD VALUE OR PRESS";
    PRINT " <F1> TO EXIT";TAB(80);" ";
    LOCATE 25,1,0
    PRINT "  USE ARROW KEYS, PgUp, PgDn. THERE ARE";
    PRINT " MORE VALUES THAN SHOWN ON THIS SCREEN";TAB(80);" ";
    GOTO SCAN2

CHOOSE2:
    DEF SEG = 0:POKE 1050,PEEK(1052)
SELECT2:
    SEL$ = INKEY$
SCAN2:
    IF SEL$ = "" THEN GOTO SELECT2
    IF SEL$ = "H" OR SEL$ = "I" OR SEL$ = "K" THEN GOTO CHOOSE2
    IF SEL$ = "M" OR SEL$ = "P" OR SEL$ = "Q" THEN GOTO CHOOSE2
    SEL = ASC(RIGHT$(SEL$,1))
    IF SEL = 72 THEN GOTO UP
    IF SEL = 73 THEN GOTO PAGEUP
    IF SEL = 27 THEN GOTO REPDEF
    IF SEL = 80 OR SEL = 13 GOTO DOWN
    IF SEL = 81 THEN GOTO PAGEDOWN
    IF SEL = 75 OR SEL = 8 THEN GOTO CURLEFT
    IF SEL = 77 OR SEL = 32 THEN GOTO CURRIGHT
    IF SEL <> 46 AND (SEL < 47 OR SEL > 58) THEN GOTO CHOOSE2
    GOTO CURRIGHT

REPDEF:
    COLOR 0,3
    SUBSCRPT = FIRSTLINE + ((CURLINE-2)/4)
    A(SUBSCRPT,0) = HOLD(SUBSCRPT,0)
    A(SUBSCRPT,1) = HOLD(SUBSCRPT,1)
    IF SUBSCRPT = 22 THEN A(SUBSCRPT,1) = 0:GOSUB CALCINTERCEP
    GOSUB BLANK
    LOCATE CURLINE,1,0
    COLOR 30,3
    PRINT CHR$(95)
    GOTO SCAN
```

```
CURRIGHT:
   COLOR 0,3
   THISCOL = SCREEN(CURLINE,CURCOL)
   IF THISCOL = 95 THEN THISCOL = 32
   LOCATE CURLINE,CURCOL,0
   IF SEL = 77 THEN PRINT CHR$(THISCOL)
   IF SEL <> 77 THEN PRINT CHR$(SEL)
   CURCOL = CURCOL + 1
   IF CURCOL > 10 THEN CURCOL = 10
   GOTO FLASH

CURLEFT:
   COLOR 0,3
   THISCOL = SCREEN(CURLINE,CURCOL)
   IF THISCOL = 95 THEN THISCOL = 32
   LOCATE CURLINE,CURCOL,0
   IF SEL = 75 THEN PRINT CHR$(THISCOL)
   IF SEL = 8 THEN SEL = 32
   IF SEL <> 75 THEN PRINT CHR$(SEL)
   CURCOL = CURCOL - 1
   IF CURCOL < 1 THEN CURCOL = 1
   GOTO FLASH

FLASH:
   COLOR 30,3
   LOCATE CURLINE,CURCOL,0
   FLASHCHAR = SCREEN(CURLINE,CURCOL)
   IF FLASHCHAR = 32 OR FLASHCHAR = 8 THEN FLASHCHAR = 95
   PRINT CHR$(FLASHCHAR)
   GOTO SELECT2

OVERFLOW:
   SCREEN 0,1,DISPAGE,DISPAGE
   COLOR 14,4
   LOCATE 25,1,0
   PRINT TAB(16);"NUMBER TOO LARGE OR INVALID, PLEASE RE-ENTER";TAB(80);" ";

PAUSE:
   SEL$ = INKEY$
   IF SEL$ = "" THEN GOTO PAUSE
   LOCATE 24,1,0
   COLOR 14,4
   PRINT "      ENTER VALUE, PRESS <ESC> TO RESTORE OLD VALUE OR PRESS";
   PRINT " <F1> TO EXIT";TAB(80);" ";
   LOCATE 25,1,0
   PRINT "  USE ARROW KEYS, PgUp, PgDn. THERE ARE";
   PRINT " MORE VALUES THAN SHOWN ON THIS SCREEN";TAB(80);" ";
   GOTO PASS

QUIT:
  TITLE$ = "                              Change / Save / Review Menu"
```

```
  MENU$(1) = "1. Continue Program (Fate Calculations)"
  MENU$(2) = "2. Save Data to Disk"
  MENU$(3) = "3. Change / Review Data"
  MENU$(4) = "4. Load a Data File or Restore Defaults"
  MENU$(5) = "5. Restart Program From Beginning"
  MENU$(6) = "6. Help and Instructions"
  MENU$(7) = "7. Exit HERBICIDE Program"
  RESULT$(1) = "CALC"
  RESULT$(2) = "SAVE"
  RESULT$(3) = "ENTER"
  RESULT$(4) = "INPUT"
  RESULT$(5) = "SELECT"
  RESULT$(6) = "HELP1"
  RESULT$(7) = "QUIT"
  MAXITEM = 7
  CHAIN PPATH$ + "MENU"

TRAP:
  SCREEN 2
  SCREEN 0,1,0,0
  COLOR 7,1
  CLS
  PRINT " ";TAB(30);"ERROR INFORMATION"
  COLOR 14,1
  PRINT "═══════════════════════════════════════";
  PRINT "═══════════════════════════════════════"
  DEF SEG=0:POKE 1050,PEEK(1052)
KNOWN:
  IF ERR < 24 THEN GOTO UNKNOWN
  IF ERR = 26 THEN GOTO UNKNOWN
  IF ERR > 27 AND ERR < 52 THEN GOTO UNKNOWN
  IF ERR > 53 AND ERR < 61 THEN GOTO UNKNOWN
  IF ERR > 61 AND ERR < 68 THEN GOTO UNKNOWN
  IF ERR = 69 THEN GOTO UNKNOWN
  IF ERR > 72 AND ERR < 76 THEN GOTO UNKNOWN
  IF ERR > 76 THEN GOTO UNKNOWN
  LOCATE 8,10,0
  PRINT "AN ERROR HAS OCCURRED DURING THE OPERATION OF THIS PROGRAM:"
  LOCATE 10,5,0
  IF ERR = 24 THEN PRINT "DISK DRIVE OR PRINTER IS NOT TURNED ON";
    IF ERR = 24 THEN PRINT "OR PLUGGED IN"
  IF ERR = 25 THEN PRINT "HARDWARE MALFUNCTION"
  IF ERR = 27 THEN PRINT "THE PRINTER IS OUT OF PAPER"
  IF ERR = 52 THEN PRINT "THE FILE NAME IS INVALID. RENAME THE FILE."
  IF ERR = 61 THEN PRINT "YOU WILL HAVE TO USE A NEW DISK. THIS ONE IS FULL!"
  IF ERR = 68 THEN PRINT "TARGET DEVICE DOES NOT EXIST, THIS PROGRAM"
    IF ERR = 68 THEN PRINT "ATTEMPTED TO ACCESS A DISK DRIVE OR PRINTER"
    IF ERR = 68 THEN PRINT "WHICH IS NOT PRESENT. SOFTWARE MUST BE RE-"
    IF ERR = 68 THEN PRINT "CONFIGURED TO PERFORM THE REQUESTED ACTION"
  IF ERR = 70 THEN PRINT "THE DISK IS WRITE PROTECTED"
  IF ERR = 53 OR ERR = 76 THEN PRINT "PROBABLY THE WRONG DISK IS IN";
    IF ERR = 53 OR ERR = 76 THEN PRINT " THE DISK DRIVE."
```

```
   IF ERR = 71 THEN PRINT "EITHER THE DISK DRIVE DOOR IS OPEN OR THERE";
     IF ERR = 71 THEN PRINT " IS NO DISK IN THE DRIVE"
   IF ERR = 72 THEN PRINT "THE DISKETTE IS PROBABLY BAD. USE A NEW DISKETTE"
   GOTO PAUSE1
UNKNOWN:
   LOCATE 10,5,0
   PRINT "AN ERROR HAS BEEN IDENTIFIED IN THIS PROGRAM. PLEASE CONTACT"
   LOCATE 11,5,0
   PRINT "YOUR SOFTWARE SUPPORT REPRESENTATIVE AND REPORT THAT ERROR"
   LOCATE 12,5,0
   PRINT "NUMBER";ERR;" OCCURRED IN SUB-ROUTINE: ";LINK$
   LOCATE 20,28,0
   COLOR 20
   PRINT "PRESS ANY KEY TO CONTINUE"
   COLOR 14,1
   GOTO SCAN1
PAUSE1:
   LOCATE 20,15,0
   COLOR 20
   PRINT "CORRECT THIS ERROR AND PRESS ANY KEY TO CONTINUE"
   COLOR 14,1
   CLOSE
SCAN1:
   SEL$ = INKEY$
   IF SEL$ = "" THEN GOTO SCAN1
   CLS
   RESUME BEGIN
```

Subroutine SAVE

```
START:
    DIM A$(24,2)
    DIM A(24,1)
    DIM F$(60)
    DIM B(25)
    DIM MENU$(10)
    DIM RESULT$(10)
    DIM FILESIN$(60)
    COMMON DSKID$,A$(),A(),F$(),B(),TYPE$,DIRECT$,UNITS$
    COMMON PPMDAYS,INITBIOM,DIR$,SPECNAME$,PERDRY
    COMMON CHEMNAME$,PRNTPLACE$,LINK$,PPATH$,DPATH$
    COMMON MENU$(),MAXITEM,RESULT$(),TITLE$,COUNT,CURBIOM
    LINK$ = "SAVE"
    ON ERROR GOTO TRAP
    SCREEN 0,1,0,0
    IF DSKID$ = "HD" THEN GOTO BEGIN
    OPEN PPATH$ + "DSKID.CHK" FOR INPUT AS #1
    INPUT #1,DSKID$
    CLOSE #1
    IF DSKID$ = "PROG1" OR DSKID$ = "HD" THEN GOTO CHKDATA
    CLS
    LOCATE 12,15,0
```

```
    PRINT"Please Place Program Disk 1 in Drive ";PPATH$
    LOCATE 14,15,0
    PRINT"and Press Any Key to Continue"

    CHKCHOOSE:
       SEL$=INKEY$
       IF SEL$="" THEN GOTO CHKCHOOSE
       GOTO START

CHKDATA:
    OPEN DPATH$ + "DSKID.CHK" FOR INPUT AS #1
    INPUT #1,DSKID$
    CLOSE #1
    IF DSKID$ = "DATA" OR DSKID$ = "HD" THEN GOTO BEGIN
    CLS
    LOCATE 12,15,0
    PRINT"Please Place the Data Disk for the Herbicide and Target"
    LOCATE 14,15,0
    PRINT"Plant Species You Will be Using in Drive ";DPATH$
    LOCATE 16,20,0
    PRINT"and Press Any Key to Continue"

    SIT:
       SEL$=INKEY$
       IF SEL$="" THEN GOTO SIT


'================== DISK FILE DIRECTORY ==========================

BEGIN:
  SHELL "DIR " + DPATH$ + DIRECT$ + DIR$ + "\*.* >" + DPATH$ + "FILES.DAT"
  OPEN DPATH$ + "FILES.DAT" FOR INPUT AS #1
  READLOOP:
    FOR I = 1 TO 59
       INPUT #1,TEXTIN$
       IF EOF(1) THEN GOTO KILLFILE
       IF I < 5 THEN GOTO READEND
       IF MID$(TEXTIN$,14,1) = "<" THEN I = I - 1:GOTO READEND
       FILESIN$(I - 4) = LEFT$(TEXTIN$,13)
  READEND:
    NEXT I
  CLOSE

KILLFILE:
  SHELL "ERASE " + DPATH$ + "FILES.DAT"
  IF I > 59 THEN GOTO OVERFLOW1

PRINTOUT:
   CLOSE
   COLOR 14,1
   CLS
   ROW = 2
```

```
    COL = 5
    PRTLIN = 1
    PRTCOL = 5
    LOCATE 23,1,0
    COLOR 14,4
    PRINT" <";DIRECT$;DIR$;"> ";
    PRINT " FILES CURRENTLY ON THIS DISK ARE LISTED ABOVE. PLEASE PRESS";
    PRINT TAB(80);" ";
    LOCATE 24,1,0
    PRINT " <ENTER> IF YOU DO NOT WISH TO SAVE A FILE.";
    PRINT " NOTE: ALL FILES END IN .DAT";
    PRINT TAB(80);" ";
    ELEMENT = 0
    COLOR 14,1
PRINTLOOP:
    COLOR 14,1
    FOR K = 1 TO 21
       IF ELEMENT = I - 4 THEN GOTO ENTERNAME
       PRTLIN = PRTLIN + 1
       IF K < 21 THEN ELEMENT = ELEMENT + 1:GOTO SKIP
       PRTCOL = PRTCOL + 22
       PRTLIN = 1
       GOTO PRINTLOOP
     SKIP:
       IF ELEMENT = I - 4 THEN COLOR 4
       LOCATE PRTLIN,PRTCOL,0
       PRINT FILESIN$(ELEMENT)
       COLOR 14,1
       GOTO NEXTK
NEXTK:
    NEXT K

OVERFLOW1:
    COLOR 2,8,1
    CLS
    PRINT"THERE ARE TOO MANY FILES FOR THIS ROUTINE."
    PRINT"TO SAVE YOUR FILE, YOU MUST ENTER THE NAME"
    PRINT"OF THE FILE BELOW (INCLUDING EXTENSION):"
    PRINT:PRINT:INPUT"ENTER FILE NAME===> ";FILE$
    DEF SEG=0:POKE 1050,PEEK(1052)

ENTERNAME:
    LOCATE 22,10,0
    INPUT "ENTER SAVE FILE NAME ===>";FILE$
    IF FILE$ = "" THEN CHAIN "MENU"
    FOR K = 1 TO LEN(FILE$)
      IF K = 9 THEN FILE$ = LEFT$(FILE$,8):GOTO ENDK
      IF MID$(FILE$,K,1) = "." THEN FILE$ = LEFT$(FILE$,K-1):GOTO ENDK
    ENDK:
    NEXT K
    TEMPFILE$ = ""
    FOR K = 1 TO LEN(FILE$)
```

```
      TEMPCHAR = ASC(MID$(FILE$,K,1))
      IF TEMPCHAR < 48 THEN GOTO ANOTHERK
      IF TEMPCHAR > 57 AND TEMPCHAR < 64 THEN GOTO ANOTHERK
      IF TEMPCHAR > 90 AND TEMPCHAR < 97 THEN GOTO ANOTHERK
      IF TEMPCHAR > 122 THEN GOTO ANOTHERK
      TEMPFILE$ = TEMPFILE$ + CHR$(TEMPCHAR)
    ANOTHERK:
    NEXT K
    FILE$ = TEMPFILE$
    FILE$ = FILE$ + ".DAT"
    CAP$=""
    FOR L = 1 TO LEN(FILE$)
    CHK$=MID$(FILE$,L,1)
    IF ASC(CHK$)<123 AND ASC(CHK$)>96 THEN CHK$=CHR$((ASC(CHK$))-32)
    CAP$=CAP$+CHK$
    NEXT L
    FILE$=CAP$
    FOR J = 1 TO ELEMENT
      HOLD$="":HOLD2$=""
      FOR K=1 TO 8
        HOLD$=MID$(FILESIN$(J),K,1)
        IF HOLD$=CHR$(32) THEN GOTO KNEXT ELSE HOLD2$=HOLD2$+HOLD$
      KNEXT:
      NEXT K
      IF FILE$ = ".DAT" THEN CHAIN PPATH$ + "MENU"
      IF FILE$=HOLD2$ + ".DAT" THEN GOTO EXISTS
    NEXT J
    GOTO SELECTED

EXISTS:
    CLS
    LOCATE 12,5,0
    PRINT"FILE NAME SELECTED ";FILE$;" ALREADY EXISTS."
    DEF SEG=0:POKE 1050,PEEK(1052)
    INPUT"    DO YOU WANT TO REPLACE IT (Y/N)";SEL$
    IF SEL$="Y" OR SEL$="y" THEN GOTO SELECTED
    IF SEL$="N" OR SEL$="n" THEN GOTO PRINTOUT
    GOTO EXISTS

SELECTED:
    CLS
    LOCATE 12,3,0
    PRINT" ";TAB(60);" "
    LOCATE 12,3,0
    PRINT "FILE NAME SELECTED IS: ";FILE$
    PRINT"  IF THIS IS CORRECT, PRESS <ENTER>.";
    PRINT " OTHERWISE, ENTER A SLASH ( / )"
    DEF SEG=0:POKE 1050,PEEK(1052)

CHOOSE:
    INPUT SEL$
    IF SEL$="" THEN GOTO SAVEIT
```

```
    SEL=ASC(SEL$)
    IF SEL=47 GOTO PRINTOUT
    GOTO CHOOSE

SAVEIT:
    OPEN DPATH$ + DIRECT$ + DIR$ + "\" + FILE$ FOR OUTPUT AS #1
    WRITE #1,"",UNITS$
    FOR I=1 TO 24
    WRITE #1,A(I,0),A(I,1)
    NEXT I
    CLOSE #1
    DEF SEG=0:POKE 1050,PEEK(1052)
    CLS
    LOCATE 12,5,0
    PRINT"DATA HAS BEEN SAVED IN ";FILE$;". PRESS <ENTER> TO CONTINUE"
    INPUT X$
    CHAIN PPATH$ + "MENU"

TRAP:
  SCREEN 2
  SCREEN 0,1,0,0
  COLOR 7,1
  CLS
  PRINT " ";TAB(30);"ERROR INFORMATION"
  COLOR 14,1
  PRINT "═══════════════════════════════════════";
  PRINT "═══════════════════════════════════════"
  DEF SEG=0:POKE 1050,PEEK(1052)
KNOWN:
  IF ERR < 24 THEN GOTO UNKNOWN
  IF ERR = 26 THEN GOTO UNKNOWN
  IF ERR > 27 AND ERR < 52 THEN GOTO UNKNOWN
  IF ERR > 53 AND ERR < 61 THEN GOTO UNKNOWN
  IF ERR > 61 AND ERR < 68 THEN GOTO UNKNOWN
  IF ERR = 69 THEN GOTO UNKNOWN
  IF ERR > 72 AND ERR < 76 THEN GOTO UNKNOWN
  IF ERR > 76 THEN GOTO UNKNOWN
  LOCATE 8,10,0
  PRINT "AN ERROR HAS OCCURRED DURING THE OPERATION OF THIS PROGRAM:"
  LOCATE 10,5,0
  IF ERR = 24 THEN PRINT "DISK DRIVE OR PRINTER IS NOT TURNED ON";
    IF ERR = 24 THEN PRINT "OR PLUGGED IN"
  IF ERR = 25 THEN PRINT "HARDWARE MALFUNCTION"
  IF ERR = 27 THEN PRINT "THE PRINTER IS OUT OF PAPER"
  IF ERR = 52 THEN PRINT "THE FILE NAME IS INVALID. RENAME THE FILE."
  IF ERR = 61 THEN PRINT "YOU WILL HAVE TO USE A NEW DISK. THIS ONE IS FULL"
  IF ERR = 68 THEN PRINT "TARGET DEVICE DOES NOT EXIST, THIS PROGRAM"
    IF ERR = 68 THEN PRINT "ATTEMPTED TO ACCESS A DISK DRIVE OR PRINTER"
    IF ERR = 68 THEN PRINT "WHICH IS NOT PRESENT. SOFTWARE MUST BE RE-"
    IF ERR = 68 THEN PRINT "CONFIGURED TO PERFORM THE REQUESTED ACTION"
  IF ERR = 70 THEN PRINT "THE DISK IS WRITE PROTECTED"
  IF ERR = 53 OR ERR = 76 THEN PRINT "PROBABLY THE WRONG DISK IS IN";
```

```
    IF ERR = 53 OR ERR = 76 THEN PRINT " THE DISK DRIVE."
  IF ERR = 71 THEN PRINT "EITHER THE DISK DRIVE DOOR IS OPEN OR THERE";
    IF ERR = 71 THEN PRINT " IS NO DISK IN THE DRIVE"
  IF ERR = 72 THEN PRINT "THE DISKETTE IS PROBABLY BAD. USE A NEW DISKETTE"
  GOTO PAUSE
UNKNOWN:
  LOCATE 10,5,0
  PRINT "AN ERROR HAS BEEN IDENTIFIED IN THIS PROGRAM. PLEASE CONTACT"
  LOCATE 11,5,0
  PRINT "YOUR SOFTWARE SUPPORT REPRESENTATIVE AND REPORT THAT ERROR"
  LOCATE 12,5,0
  PRINT "NUMBER";ERR;" OCCURRED IN SUB-ROUTINE: ";LINK$
  LOCATE 20,28,0
  COLOR 20
  PRINT "PRESS ANY KEY TO CONTINUE"
  COLOR 14,1
  GOTO SCAN
PAUSE:
  LOCATE 20,15,0
  COLOR 20
  PRINT "CORRECT THIS ERROR AND PRESS ANY KEY TO CONTINUE"
  COLOR 14,1
  CLOSE
SCAN:
  SEL$ = INKEY$
  IF SEL$ = "" THEN GOTO SCAN
  CLS
  RESUME START
```

Subroutine CALC

```
START:
   DIM A$(24,2)
   DIM A(24,1)
   DIM F$(60)
   DIM B(25)
   DIM MENU$(10)
   DIM RESULT$(10)
   COMMON DSKID$,A$(),A(),F$(),B(),TYPE$,DIRECT$,UNITS$
   COMMON PPMDAYS,INITBIOM,DIR$,SPECNAME$,PERDRY
   COMMON CHEMNAME$,PRNTPLACE$,LINK$,PPATH$,DPATH$
   COMMON MENU$(),MAXITEM,RESULT$(),TITLE$,COUNT,CURBIOM
   LINK$ = "CALC"
   ON ERROR GOTO TRAP
   SCREEN 0,1,0,0
   COLOR 4,1,6
   IF DSKID$ = "HD" THEN GOTO BEGIN
   OPEN PPATH$ + "DSKID.CHK" FOR INPUT AS #1
   INPUT #1,DSKID$
   CLOSE #1
   IF DSKID$ = "PROG1" THEN GOTO BEGIN
   CLS
```

```
    LOCATE 12,15,0
    PRINT"Please Place Program Disk 1 in Drive ";PPATH$
    LOCATE 14,15,0
    PRINT"and Press Any Key to Continue"

    CHKCHOOSE:
       SEL$=INKEY$
       IF SEL$="" THEN GOTO CHKCHOOSE

BEGIN:
    DEF SEG=0:POKE 1050,PEEK(1052)
    COLOR 14,1
    CLS
    LOCATE 8,4,0
    PRINT "This Portion of Module 1 Calculates the Fate";
    PRINT " of Herbicides in Aquatic"
    LOCATE 10,5,0
    PRINT"Environments. These Calculations Will";
    PRINT " be Performed for 14 Days or Until"
    LOCATE 12,7,0
    PRINT "Concentrations of Herbicide in Either Water or Plants";
    PRINT " Have Dropped to"
    LOCATE 14,8,0
    PRINT "Less than 0.1% of Peak Concentrations.";
    PRINT " At the Termination of These"
    LOCATE 16,10,0
    PRINT "Calculations You Will be Given the Option of Continuing the"
    LOCATE 18,19,0
    PRINT "Calculations for a Period of Your Choice."
    LOCATE 21,18,0
    INPUT "Press <ENTER> to Begin Fate Calculations";X$
    '********** CONVERT CUSTOMARY TO METRIC ********************
    FOR I = 1 TO 24
      B(I) = 0
    NEXT I
    B(1) = 1
    FOR I = 2 TO 25
      B(I) = A(I-1,0)
    NEXT I

    IF UNITS$ = "M" THEN GOTO CALC1
    B(2) = B(2) * 0.3048        :'feet ==> meters
    B(3) = B(3) * 0.3048        :'feet ==> meters
    B(5) = B(5) * 2.54          :'inches ==> cm
    B(7) = B(7) * 2.54          :'inches ==> cm
    B(8) = B(8) * 2.54          :'inches ==> cm
    B(9) = B(9) * 2.54          :'inches ==> cm
    B(11) = B(11) * 0.1198      :'lb/gal ==> kg/l
    B(12) = B(12) * 9.353       :'gal/acre ==> l/ha
    B(24) = B(24) * 2.2417      :'tons/acre ==> metric tons/ha

CALC1:
```

```
'********** TREATMENT AREA SQ. METERS ********************
TAREA = B(1) * 10000          :'10000 SQ. METERS/HA.
'********** WATER VOLUME CU. METERS ***********************
WVOL = TAREA * B(2)           :'B(2) IS DEPTH IN METERS
'********** WATER VOLUME LITERS ****************************
WVOL = WVOL * 1000            :'1000 L / CU. METER
'********** SUSPENDED SOLIDS MASS (KG) *********************
TSSMASS = (B(4) * WVOL) / 1000000
'MG/L * LITERS DIVIDED BY 1,000,000 MG/KG ==> MG/CU. METER

'******** VOLUME OF SEDIMENTS CU. METERS ******************
VOLSED = TAREA * (B(5) / 100)
'AREA SQ. METERS * DEPTH CM. / 100 CM/M
'******* SEDIMENT INTERSTITIAL WATER (LITERS) *************
SIW = (B(6) / 100) * (VOLSED * 1000)
'PERCENT WATER/100 * CU. M * 1000 L/CU. M
'****** SOLID VOLUME OF SEDIMENTS (CUBIC DECIMETERS) ******
RVS = (VOLSED * 1000) - SIW
'CU. METERS * 1000 CU. DM./CU. M    - L WATER
'**** CALCULATE SEDIMENT DENSITY FOR MASS FROM VOL. CALC **
SEDDENS = -1.441 * (B(6) / 100) + 2.188
'REGRESSION FROM PAT MAYSE LAKE TEXAS
'*************** MASS OF SEDIMENT SOLIDS (KG) **************
SEDMASS = ((RVS * 1000) * SEDDENS) / 1000
'CU. DM * 1000 CU. CM/CU. DM * DENSITY
'G/CU. CM ALL OVER 1000 (G==> KG)
IF SEDMASS <= 0 THEN SEDMASS = 0.00001
'*************** TOTAL MASS OF PLANTS (KG) ******************
MP = (B(24) * 1000) * B(1)
'MET. TONS * 1000 KG/MET. TON * AREA (HA.)
IF MP <= 0 THEN MP = 0.00001
'********** INITIAL VOL PURE CHEMICAL APPLIED ***************
HMASS = (B(1) * B(11)) * B(12) * (1 - (B(13) / 100))
'ha * l/ha = l  l * kg/l = kg  kg * l/%drift = kg
'*************** SEDIMENTATION RATE CU. M/YEAR **************
SEDVOL = (B(8) / 100) * TAREA
'CM/YEAR /100 CM/M * SQ. METERS
'******** SEDIMENTATION IN CU. CM / DAY *********************
SEDVOL = (SEDVOL * 1000000) / 365
'CU. M/YEAR * 1,000,000 CU. CM/CU. M OVER 365 DAYS/YEAR
'******* RESUSPENSION RATE CU. M/YEAR ***********************
RESVOL = (B(9) / 100) * TAREA
'AS ABOVE FOR SEDIMENTATION
'***** RESUSPENSION RATE IN CU. CM / DAY *******************
RESVOL = (RESVOL * 1000000) / 365
'AS ABOVE FOR SEDIMENTATION
'**** NET SEDIMENTATION RATE CU. CM/DAY *******************
NETSED = SEDVOL - RESVOL
'SEDIMENTATION - RESUSPENSION
'**** MASS OF SEDIMENTATION PER DAY ************************
NETSED = (NETSED * SEDDENS) / 1000
'CU. CM * G/CU. CM OVER 1000 G/KG
```

```
'******* MASS OF SED LESS % WATER ***************************
NETSED = NETSED * (1 - (B(6) / 100))
'CU. CM/DAY * DRY WEIGHT FRACTION
'****** CROSSECTIONAL AREA OF SITE (SQ. M) ******************
XSAREA = (SQR (TAREA) * B(2))
'SQUARE ROOT OF AREA (M) x DEPTH (M)
'******* FLOW VOLUME FROM AREA L/DAY *************************
FLOWVOL = (XSAREA * (B(3) * 1440)) * 1000
'SQ. METERS X M/MIN. X 1440 MIN./DAY * 1000 L/CU. M
'*** CALCULATE FATE AND RELEASE COEFFICIENTS FROM /DAY *****
CLS
PEAK = 0
COUNT = 0
STACNT = 0:STPCNT = 14.1
KEY OFF
'******* PREVENT DIVISION BY ZERO ****************************
FOR G = 1 TO 24
  IF B(G) <= 0 THEN B(G) = 0.00001
NEXT G
'***** HERBICIDE RELEASE COEFFICIENT FROM /DAY **************
HRATE = 0.6931 / B(10)
'*** SUM OF WATER FATE PROCESSES AND  *****
'*** CONVERT FROM /DAY TO COEFFICIENT *****
WFATE = (.6931/B(15)) + (0.6931 / B(17)) + (0.6931 / B(19))
WFATE = WFATE + (0.6931 / B(21)) + (0.6931 / B(22))
'*** SUM OF SED. FATE PROCESSES AND   *****
'*** CONVERT FROM /DAY TO COEFFICIENT *****
SFATE = (0.6931 / B(16)) + (0.6931 / B(18)) + (0.6931 / B(20))
'*** BIOCONCENTRATION FACTOR *******************************
IF TYPE$ = "FLOATING" THEN INTERCEPT = B(23) ELSE BCF = B(23)
'****************** SELECT output TYPE ***********************
CLS
LOCATE 12,5,0
PRINT"  Would You Like numerical and graphic output or just graphic?"
LOCATE 15,5,0
PRINT"                    Graphic                    Both"
LOCATE 23,15,0
PRINT"MOVE CURSOR TO DESIRED SELECTION AND PRESS <ENTER>"
LOCATE 15,21,0
COLOR 19
PRINT CHR$(178)
OUTTYPE$ = "GRAPH"
DEF SEG=0:POKE 1050,PEEK(1052)

CHOOSE1:
  CURSOR$ = INKEY$
  IF CURSOR$ = "" THEN GOTO CHOOSE1
  CURSOR$ = RIGHT$(CURSOR$,1)
  IF CURSOR$ = CHR$(13) THEN GOTO SELOUT
  IF CURSOR$ = CHR$(77) THEN GOTO BOTHOUT
  IF CURSOR$ = CHR$(75) THEN GOTO GRAPHOUT
  GOTO CHOOSE1
```

```
GRAPHOUT:
   LOCATE 15,46,0
   PRINT " "
   LOCATE 15,21,0
   PRINT CHR$(178)
   OUTTYPE$ = "GRAPH"
   GOTO CHOOSE1

BOTHOUT:
   LOCATE 15,21,0
   PRINT " "
   LOCATE 15,46,0
   PRINT CHR$(178)
   OUTTYPE$ = "BOTH"
   GOTO CHOOSE1

SELOUT:
   IF OUTTYPE$ = "GRAPH" THEN GOTO SETHRATE
   '********* SELECT output device ****************************
   COLOR 14,1
   CLS
   LOCATE 12,5,0
   PRINT"  Would You Like the output to go to the screen or the printer?"
   LOCATE 15,5,0
   PRINT"                    Screen                    Printer"
   LOCATE 23,15,0
   PRINT"MOVE CURSOR TO DESIRED SELECTION AND PRESS <ENTER>"
   LOCATE 15,21,0
   COLOR 19
   PRINT CHR$(178)
   PRNTPLACE$ = "SCRN:"
   DEF SEG=0:POKE 1050,PEEK(1052)

CHOOSE2:
   CURSOR$ = INKEY$
   IF CURSOR$ = "" THEN GOTO CHOOSE2
   CURSOR$ = RIGHT$(CURSOR$,1)
   IF CURSOR$ = CHR$(13) THEN GOTO STARTOUT
   IF CURSOR$ = CHR$(77) THEN GOTO PRINTER
   IF CURSOR$ = CHR$(75) THEN GOTO CRTOUT
   GOTO CHOOSE2

CRTOUT:
   LOCATE 15,46,0
   PRINT " "
   LOCATE 15,21,0
   PRINT CHR$(178)
   PRNTPLACE$ = "SCRN:"
   GOTO CHOOSE2

PRINTER:
```

```
    LOCATE 15,21,0
    PRINT " "
    LOCATE 15,46,0
    PRINT CHR$(178)
    PRNTPLACE$ = "LPT1:"
    GOTO CHOOSE2

STARTOUT:
    OPEN PRNTPLACE$ FOR OUTPUT AS #2
    CLS

SETHRATE:
    IF HRATE > 1 THEN ITER = 0.1:GOTO COUNTP
    IF HRATE <= 1 AND HRATE > 0.1 THEN ITER = 0.1:GOTO COUNTP
    IF HRATE < 0.1 THEN ITER = 0.5

COUNTP:
    FLOWVOL = FLOWVOL * ITER
    IF (FLOWVOL / (WVOL * ITER)) = 1 THEN FLOWVOL = WVOL * ITER
    COUNTP=0:OVERIDE=0
    CLS
    COLOR 14,1
    IF OUTTYPE$ <> "GRAPH" THEN GOTO NOTGRAPH
    LOCATE 12,6,0
    PRINT "CALCULATIONS IN PROGRESS, PLEASE WAIT. CALCULATING FOR DAY:"

NOTGRAPH:
    IF PRNTPLACE$ = "LPT1:" THEN PRNTFLG=0 ELSE PRNTFLG=1
    WPCO = 1
    PMASS = HMASS * (INTERCEPT / 100)
    OMASS = HMASS - PMASS
    '** MAXIMUM POSSIBLE WATER CONCENTRATION PPM **************
    IF WVOL = 0 THEN WVOL = 0.00001
    WMAXCON = (OMASS * 1000000) / WVOL
    WCONC = 0:PCONC = 0:SCONC = 0:AMTREL = 0:DMDT = 0:WMASS = 0
    SMASS = 0:SEDDEPTH = 0:TSSCONC = 0:SIWCONC = 0
    WPEAK = 0:PPEAK = 0:PPMDAYS = 0:CHEMMASS = 0
    '******** release of herbicide to water **************
    MASSW = WVOL          :'KG WATER
    MASSS = SEDMASS       :'KG SEDIMENT
    MASSP = MP            :'KG PLANTS
    MASST = TSSMASS       :'KG TOTAL SUSPENDED SOLIDS
    MASSI = SIW           :'KG INTERSTITIAL WATER
    KP = B(14)            :'RATIO OF SEDIMENT/WATER CONC
    BCF = B(23)           :'RATIO OF PLANT/WATER CONC

TIMELOOP2:
    FOR TIME = STACNT TO STPCNT STEP ITER
    COUNTP = COUNTP + 1
    DMDT = (OMASS * (1 - EXP(-HRATE * TIME))) - AMTREL
    AMTREL = AMTREL + DMDT
    CHEMMASS = CHEMMASS + DMDT
```

```
    SEDDEPTH = B(7) * TIME
    IF SEDDEPTH <= 0 THEN SEDDEPTH = 0.00001
    IF SEDDEPTH > B(5) THEN SEDDEPTH = B(5)
    EFFMASS = (MASSW * WPCO) + (MASSS * KP)
    EFFMASS = EFFMASS + (MASST * KP) + (MASSI * WPCO)
    IF TYPE$ <> "FLOATING" THEN EFFMASS = EFFMASS + (MASSP * BCF)
    MASSS = SEDMASS * (SEDDEPTH / B(5))
    MASSS = MASSS + (NETSED * ITER)
    SRATIO = ((MASSS * KP) / EFFMASS)
    IF TYPE$ <> "FLOATING" THEN PRATIO = ((MASSP * BCF) / EFFMASS)
    WRATIO = ((MASSW * WPCO) / EFFMASS)
    TRATIO = ((MASST * KP) / EFFMASS)
    IRATIO = ((MASSI * WPCO) / EFFMASS)
    TOTRATIO = WRATIO + SRATIO + TRATIO + IRATIO
    IF TYPE$ <> "FLOATING" THEN TOTRATIO = TOTRATIO + PRATIO
    WMASS = WRATIO * CHEMMASS
    WMASS = WMASS * EXP(-WFATE * ITER)
    IF TYPE$ <> "FLOATING" THEN PMASS = PRATIO * CHEMMASS:GOTO NOTFLOAT2
    DPDT = (PMASS * (1 - EXP(-WFATE * ITER)))
    AMTGONE = AMTGONE + DPDT
    PMASS = PMASS - DPDT
NOTFLOAT2:
    SMASS = SRATIO * CHEMMASS
    SMASS = SMASS * EXP(-SFATE * ITER)
    TMASS = TRATIO * CHEMMASS
    TMASS = TMASS * EXP(-SFATE * ITER)
    IMASS = IRATIO * CHEMMASS
    IMASS = IMASS * EXP(-WFATE * ITER)
    WCONC = (WMASS / MASSW) * 1000000
    IF WMASS < 0.00001 THEN WCONC = 0.00001
    SCONC = (SMASS / MASSS) * 1000000
    IF SMASS < 0.00001 THEN SCONC = 0.00001
    PCONC = (PMASS / MP) * 1000000
    IF PMASS < 0.00001 THEN PCONC = 0.00001
    WMASS = WMASS * (1 - (FLOWVOL / WVOL))
    IF WCONC < 0 THEN WCONC = 0
    CHEMMASS = WMASS + SMASS + TMASS + IMASS
    IF TYPE$ <> "FLOATING" THEN CHEMMASS = CHEMMASS + PMASS
    IF PCONC < 0 THEN PCONC = 0
    IF WCONC > WPEAK THEN WPEAK = WCONC
    IF PCONC > PPEAK THEN PPEAK = PCONC
    IF SCONC > SPEAK THEN SPEAK = SCONC
    IF OUTTYPE$ <> "GRAPH" THEN GOTO CHECKCOUNT
    LOCATE 12,65,0
    PRINT USING "###.##";TIME
    GOTO CHECKWCONC

CHECKCOUNT:
    IF COUNT > 0 THEN GOTO PRINTBLNK1
    COLOR 4
    PRINT #2,"                          fate calculations output"
    COLOR 14,1
```

```
    PRINT #2,"              time        water        plants        sediments"
    PRINT #2,"             (days)       (mg/l)       (mg/kg)       (mg/kg)"

 PRINTBLNK1:
    PRINT #2,"            ";
    PRINT #2,USING"####.##";TIME;
    PRINT #2,"      ";
    PRINTTEMP = (WMAXCON * (1 - EXP(-HRATE * ITER)))
    IF TIME = 0 THEN PRINT #2,USING "###.####";PRINTTEMP;
    IF TIME = 0 THEN GOTO PRINTBLNK2
    PRINT #2,USING "###.####";WCONC;

 PRINTBLNK2:
    PRINT #2,"     ";
    PRINT #2,USING "###.####";PCONC;
    PRINT #2,"     ";
    PRINT #2,USING "###.####";SCONC
    COUNT = COUNT + 1
    DEF SEG=0:POKE 1050,PEEK(1052)
    IF PRNTPLACE$ <> "SCRN:" THEN GOTO CHECKWCONC
    IF COUNT <> 20 THEN GOTO CHECKWCONC
    COUNT = 0
    INPUT"                                    Press <ENTER> to Continue";X$
    CLS

 CHECKWCONC:
    IF WCONC >= (WPEAK / 1000) THEN GOTO NEXTTIME
    IF PCONC < (PPEAK / 1000) AND OVERIDE = 0 THEN GOTO CHECKBELOW

 NEXTTIME:
    NEXT TIME

 CHECKBELOW:
    IF TIME <= STPCNT THEN GOTO PRINTBELOW
    TIME = TIME - ITER
    PRINT " Time is";
    PRINT USING "####.##";TIME;
    IF WPEAK = 0 OR PPEAK = 0 THEN CURCONC = 0.00001
    PRINT " days. Herbicide concentration in water or plants is"
    IF WPEAK = 0 OR PPEAK = 0 THEN GOTO PRINTCONC
    IF (WCONC / WPEAK) <= (PCONC / PPEAK) THEN GOTO FIXCONC
    CURCONC = (WCONC / WPEAK) * 100
    GOTO PRINTCONC

 FIXCONC:
    CURCONC = (PCONC/PPEAK) * 100

 PRINTCONC:
    PRINT USING "##.###";CURCONC;
    PRINT " percent of peak concentrations in water or plants."

 CONTCALC:
```

```
    PRINT "If you wish to continue calculations,";
    PRINT " please enter the number of"
    PRINT "additional days to continue calculation";
    PRINT " (press <ENTER> to stop now)."
    DEF SEG=0:POKE 1050,PEEK(1052)
    INPUT "enter number of days ==>";STPADD
    IF OUTTYPE$ = "GRAPH" THEN GOTO PRINTWAIT
    IF STPADD = 0 THEN GOTO CLOSEFILE
    STACNT = TIME + ITER
    STPCNT = STACNT + STPADD
    COUNT = 0
    OVERIDE = 1
    CLS
    GOTO TIMELOOP2

PRINTWAIT:
    IF STPADD = 0 THEN GOTO CLOSEFILE
    STACNT = TIME + ITER
    STPCNT = STACNT + STPADD
    COUNT = 0
    OVERIDE = 1
    CLS
    LOCATE 12,6,0
    PRINT"CALCULATIONS IN PROGRESS, PLEASE WAIT. CALCULATING FOR DAY: "
    GOTO TIMELOOP2

PRINTBELOW:
    PRINT"herbicide concentrations in plant tissue and water is below"
    PRINT"one tenth of one percent of maximum."
    GOTO CONTCALC

CLOSEFILE:
    CLOSE
    IF WPEAK > PPEAK THEN PEAK = WPEAK ELSE PEAK = PPEAK
    IF SPEAK > PEAK THEN PEAK = SPEAK
    PEAK = PEAK * 1.2
    FOR U = 1 TO 30
      PEAK = PEAK * 10
      IF PEAK > 1 THEN GOTO EXITULOOP
    NEXT U

EXITULOOP:
    PEAK = INT(PEAK)
    IF U => 1 THEN PEAK = PEAK + 1
    PEAK = (PEAK / (10^U)) * 1.2
    IF HRATE = 1000 THEN PEAK = PEAK * 2
    CLS
    LOCATE 12,5,0
    PRINT "When the Following Graph Has Finished Printing";
    PRINT " on the Screen, a Hardcopy"
    PRINT "    May be Obtained by Pressing and Holding the";
    PRINT " <SHIFT> Key and Then Pressing"
```

```
PRINT "    the <Print Screen> or <PrtSc> Key (whichever";
PRINT " your system has)."
PRINT
PRINT "    This Should be Done";
COLOR 4
PRINT " BEFORE";
COLOR 14,1
PRINT " Pressing <ENTER> as Instructed on the at the"
PRINT "    Bottom of the Graph."
PRINT:PRINT
INPUT"                              Press <ENTER> to Continue";X$
SCREEN 1,0
COLOR 0,0
CLS
PRTPOS$ = STR$(DAYS)
PRTPOS = LEN(PRTPOS$)
PRTPOS = 37 - PRTPOS
LOCATE 20,5,0
PRINT "0            TIME (DAYS)"
LOCATE 20,PRTPOS,0
PRINT USING "###.#";TIME
LOCATE 1,1,0
IF PEAK >= 100 THEN PRINT USING "####";PEAK
IF PEAK >= 10 AND PEAK < 100 THEN PRINT USING "##.#";PEAK
IF PEAK >= 1 AND PEAK < 10 THEN PRINT USING "#.##";PEAK
IF PEAK >= 0.001 AND PEAK < 1 THEN PRINT USING ".###";PEAK
IF PEAK <  0.001 THEN PRINT USING ".####";PEAK
LOCATE 10,2,0
PRINT "PPM"
LINE (39,1)-(301,151),3,B
LOCATE 21,10,0
PRINT"water     plants     sediments"
FOR LEG = 45 TO 60 STEP 2
   PSET(LEG,165),2
   PSET(LEG + 80,165),1
   PSET(LEG + 170,165),3
NEXT LEG
WCONC = 0:PCONC = 0:SCONC = 0:AMTREL = 0:DMDT = 0:DPDT = 0
WMASS = 0:PMASS = 0:SMASS = 0:SEDDEPTH = 0:TSSCONC = 0
SIWCONC = 0:WPEAK = 0:PPEAK = 0:PPMDAYS = 0:CHEMMASS = 0
PMASS = HMASS * (INTERCEPT / 100)
QMASS = HMASS - PMASS
SITCNT = TIME
STACNT = 0
ITER = TIME / 130
WPCO = 1
'******** release of herbicide to water ***************
MASSW = WVOL          :'KG WATER
MASSS = SEDMASS       :'KG SEDIMENT
MASSP = MP            :'KG PLANTS
MASST = TSSMASS       :'KG TOTAL SUSPENDED SOLIDS
MASSI = SIW           :'KG INTERSTITIAL WATER
```

```
    KP = B(14)              :'RATIO OF SEDIMENT/WATER CONC
    BCF = B(23)             :'RATIO OF PLANT/WATER CONC
    FOR TIME = STACNT TO STPCNT STEP ITER
    COUNTP = COUNTP + 1
    DMDT = (OMASS * (1 - EXP(-HRATE * TIME))) - AMTREL
    AMTREL = AMTREL + DMDT
    CHEMMASS = CHEMMASS + DMDT

NOTFLOAT3:
    SEDDEPTH = B(7) * TIME
    IF SEDDEPTH <= 0 THEN SEDDEPTH = 0.00001
    IF SEDDEPTH > B(5) THEN SEDDEPTH = B(5)
    EFFMASS = (MASSW * WPCO) + (MASSS * KP)
    EFFMASS = EFFMASS + (MASST * KP) + (MASSI * WPCO)
    IF TYPE$ <> "FLOATING" THEN EFFMASS = EFFMASS + (MASSP * BCF)
    MASSS = SEDMASS * (SEDDEPTH / B(5))
    MASSS = MASSS + (NETSED * ITER)
    SRATIO = ((MASSS * KP) / EFFMASS)
    IF TYPE$ <> "FLOATING" THEN PRATIO = ((MASSP * BCF) / EFFMASS)
    WRATIO = ((MASSW * WPCO) / EFFMASS)
    TRATIO = ((MASST * KP) / EFFMASS)
    IRATIO = ((MASSI * WPCO) / EFFMASS)
    TOTRATIO = WRATIO + SRATIO + TRATIO + IRATIO
    IF TYPE$ <> "FLOATING" THEN TOTRATIO = TOTRATIO + PRATIO
    WMASS = WRATIO * CHEMMASS
    WMASS = WMASS * EXP(-WFATE * ITER)
    IF TYPE$ <> "FLOATING" THEN PMASS = PRATIO * CHEMMASS:GOTO NOTFLOAT4
    DPDT = (PMASS * (1 - EXP(-WFATE * ITER)))
    AMTGONE = AMTGONE + DPDT
    PMASS = PMASS - DPDT
NOTFLOAT4:
    SMASS = SRATIO * CHEMMASS
    SMASS = SMASS * EXP(-SFATE * ITER)
    TMASS = TRATIO * CHEMMASS
    TMASS = TMASS * EXP(-SFATE * ITER)
    IMASS = IRATIO * CHEMMASS
    IMASS = IMASS * EXP(-WFATE * ITER)
    WCONC = (WMASS / MASSW) * 1000000
    IF WMASS < 0.00001 THEN WCONC = 0.00001
    SCONC = (SMASS / MASSS) * 1000000
    IF SMASS < 0.00001 THEN SCONC = 0.00001
    PCONC = (PMASS / MP) * 1000000
    IF PMASS < 0.00001 THEN PCONC = 0.00001
    WMASS = WMASS * (1 - (FLOWVOL / WVOL))
    IF WCONC < 0 THEN WCONC = 0
    CHEMMASS = WMASS + SMASS + TMASS + IMASS
    IF TYPE$ <> "FLOATING" THEN CHEMMASS = CHEMMASS + PMASS
    IF PCONC < 0 THEN PCONC = 0
    PPMDAYS = PPMDAYS + (PCONC * ITER)
    Y = ((260 / STPCNT) * TIME) + 40
    X= 150 - ((140 / PEAK) * WCONC)
    YW = Y
```

```
    XW = 150 - ((140 / PEAK) * PCONC)
    YS = Y
    XS = 150 - ((140 / PEAK) * SCONC)
    PSET(Y,X),2
    PSET(YW,XW),1
    PSET(YS,XS),3
    NEXT TIME
    DEF SEG=0:POKE 1050,PEEK(1052)
    LOCATE 23,1,0
    INPUT"              press <ENTER>";X$:SCREEN 2
    SCREEN 0,1,0,0
    COLOR 14,1
    CLS
    DEF SEG=0:POKE 1050,PEEK(1052)
    CLOSE
    LOCATE 12,1,0
    PRINT "                      output to module 2 (EFFECTS)"
    PRINT ""
    PRINT "           plant exposure to herbicide (MG/KG-DAYS)";
    PRINT USING"######.###";PPMDAYS
    PRINT ""
    DEF SEG=0:POKE 1050,PEEK(1052)
    INPUT"                       press <ENTER> to continue";X$
    CLS
    PERDRY = B(25)
    INITBIOM = A(23,0)
    TIMESTHRU = 1
    TITLE$ = "                              Change / Save / Review Menu"
    MENU$(1) = "1. Continue Program (Module II)"
    MENU$(2) = "2. Change / Review Data"
    MENU$(3) = "3. Save Data to Disk"
    MENU$(4) = "4. Load New Data File or Load Defaults"
    MENU$(5) = "5. Help and Instructions"
    MENU$(6) = "6. Exit HERBICIDE Program"
    RESULT$(1) = "EFFECT"
    RESULT$(2) = "ENTER"
    RESULT$(3) = "SAVE"
    RESULT$(4) = "INPUT"
    RESULT$(5) = "HELP1"
    RESULT$(6) = "QUIT"
    MAXITEM = 6
    CHAIN PPATH$ + "MENU"

TRAP:
  SCREEN 2
  SCREEN 0,1,0,0
  COLOR 7,1
  CLS
  PRINT " ";TAB(30);"ERROR INFORMATION"
  COLOR 14,1
  PRINT "═══════════════════════════════════════";
  PRINT "═══════════════════════════════════════"
```

```
  DEF SEG=0:POKE 1050,PEEK(1052)
KNOWN:
  IF ERR < 24 THEN GOTO UNKNOWN
  IF ERR = 26 THEN GOTO UNKNOWN
  IF ERR > 27 AND ERR < 52 THEN GOTO UNKNOWN
  IF ERR > 53 AND ERR < 61 THEN GOTO UNKNOWN
  IF ERR > 61 AND ERR < 68 THEN GOTO UNKNOWN
  IF ERR = 69 THEN GOTO UNKNOWN
  IF ERR > 72 AND ERR < 76 THEN GOTO UNKNOWN
  IF ERR > 76 THEN GOTO UNKNOWN
  LOCATE 8,10,0
  PRINT "AN ERROR HAS OCCURRED DURING THE OPERATION OF THIS PROGRAM:"
  LOCATE 10,5,0
  IF ERR = 24 THEN PRINT "DISK DRIVE OR PRINTER IS NOT TURNED ON";
    IF ERR = 24 THEN PRINT "OR PLUGGED IN"
  IF ERR = 25 THEN PRINT "HARDWARE MALFUNCTION"
  IF ERR = 27 THEN PRINT "THE PRINTER IS OUT OF PAPER"
  IF ERR = 52 THEN PRINT "THE FILE NAME IS INVALID. RENAME THE FILE."
  IF ERR = 61 THEN PRINT "YOU WILL HAVE TO USE A NEW DISK. THIS ONE IS FULL"
  IF ERR = 68 THEN PRINT "TARGET DEVICE DOES NOT EXIST, THIS PROGRAM"
    IF ERR = 68 THEN PRINT "ATTEMPTED TO ACCESS A DISK DRIVE OR PRINTER"
    IF ERR = 68 THEN PRINT "WHICH IS NOT PRESENT. SOFTWARE MUST BE RE-"
    IF ERR = 68 THEN PRINT "CONFIGURED TO PERFORM THE REQUESTED ACTION"
  IF ERR = 70 THEN PRINT "THE DISK IS WRITE PROTECTED"
  IF ERR = 53 OR ERR = 76 THEN PRINT "PROBABLY THE WRONG DISK IS IN";
    IF ERR = 53 OR ERR = 76 THEN PRINT " THE DISK DRIVE."
  IF ERR = 71 THEN PRINT "EITHER THE DISK DRIVE DOOR IS OPEN OR THERE";
    IF ERR = 71 THEN PRINT " IS NO DISK IN THE DRIVE"
  IF ERR = 72 THEN PRINT "THE DISKETTE IS PROBABLY BAD. USE A NEW DISKETTE"
  GOTO PAUSE
UNKNOWN:
  LOCATE 10,5,0
  PRINT "AN ERROR HAS BEEN IDENTIFIED IN THIS PROGRAM. PLEASE CONTACT"
  LOCATE 11,5,0
  PRINT "YOUR SOFTWARE SUPPORT REPRESENTATIVE AND REPORT THAT ERROR"
  LOCATE 12,5,0
  PRINT "NUMBER";ERR;" OCCURRED IN SUB-ROUTINE: ";LINK$
  LOCATE 20,28,0
  COLOR 20
  PRINT "PRESS ANY KEY TO CONTINUE"
  COLOR 14,1
  GOTO SCAN
PAUSE:
  LOCATE 20,15,0
  COLOR 20
  PRINT "CORRECT THIS ERROR AND PRESS ANY KEY TO CONTINUE"
  COLOR 14,1
  CLOSE
SCAN:
  SEL$ = INKEY$
  IF SEL$ = "" THEN GOTO SCAN
  CLS
```

```
   RESUME START

                                    Subroutine EFFECT

BEGIN:
    DIM A$(24,2)
    DIM A(24,1)
    DIM F$(60)
    DIM B(25)
    DIM MENU$(10)
    DIM RESULT$(10)
    DIM HOLD(25,1)
    COMMON DSKID$,A$(),A(),F$(),B(),TYPE$,DIRECT$,UNITS$
    COMMON PPMDAYS,INITBIOM,DIR$,SPECNAME$,PERDRY
    COMMON CHEMNAME$,PRNTPLACE$,LINK$,PPATH$,DPATH$
    COMMON MENU$(),MAXITEM,RESULT$(),TITLE$,COUNT,CURBIOM
    MAXITEMS = 24
    KEY(1) ON
    LINK$ = "EFFECT"
    SCREEN 0,1,0,0
    IF DSKID$ = "HD" THEN GOTO START
    OPEN PPATH$ + "DSKID.CHK" FOR INPUT AS #1
    INPUT #1,DSKID$
    CLOSE #1
    IF DSKID$ = "PROG1" THEN GOTO START
    CLS
    LOCATE 12,15,0
    PRINT"Please Place Program Disk 1 in Drive ";PPATH$
    LOCATE 14,15,0
    PRINT"and Press Any Key to Continue"

CHKCHOOSE:
    SEL$ = INKEY$
    IF SEL$ = "" THEN GOTO CHKCHOOSE
    GOTO START

START:
    FILE$ = DPATH$ + DIRECT$ + DIR$ + "\DEFAULT\" + DIR$ + ".BAS"
    OPEN FILE$ FOR INPUT AS #1
    INPUT #1,RESPCO,LAGCOEF
    CLOSE #1
    SCREEN 0
    COLOR 14,1
    CLS
    CIRCREC = 0
    ITER = 0.1
    IF LAGCOEF = 0 THEN LAGCOEF = 1:GOTO SKIPLAGCO

GETLAGCO:
    LAGCO = 1 / LAGCOEF
    IF TIMESCHK > 0 THEN GOTO SKIPINSTR
```

```
SKIPLAGOO:
   LOCATE 6,2,0
   PRINT "This is Module 2 (Response). The Graph Which Will Follow";
   PRINT " is a Graph of"
   LOCATE 8,2,0
   PRINT "Percent of Plants Killed vs. Exposure";
   PRINT " (mg / kg Herbicide Concentration"
   LOCATE 10,2,0
   PRINT "in Plant Tissues X Exposure Duration (Days)).";
   PRINT " From This Graph,"
   LOCATE 12,2,0
   PRINT "Percentage of Plant Population Killed is Calculated.";
   PRINT " It is Assumed for"
   LOCATE 14,2,0
   PRINT "the Purposes of Module 3 (Population Response)";
   PRINT " That the Maximum Obtainable"
   LOCATE 16,2,0
   PRINT "Kill is 99.0% of Pre-Treatment Densities so That There";
   PRINT " Remains Sufficient"
   LOCATE 18,2,0
   PRINT "Plant Material to Regrow. The Calculations Performed";
   PRINT " in This Module"
   LOCATE 20,2,0
   PRINT "Can be Modified by the User at the End of The Module";
   PRINT " and This Module Can"
   LOCATE 22,2,0
   PRINT "Then be Re-Run With the New Calculation Parameters."
   PRINT
   PRINT " ";TAB(25);
   INPUT "Press <ENTER> to Begin";X$
   CLS

SKIPINSTR:
   CIRCREC = 0
   PRCTKILL = LAGOO
   CLS
   LOCATE 12,15,0
   PRINT "calculations in progress, please wait"
   FOR PMDAYS = 0 TO 100 STEP 0.1
   DKILDPMD = (RESPOO * PRCTKILL * ((99 - PRCTKILL) / 99)) * 0.1
   PRCTKILL = PRCTKILL + DKILDPMD
   IF DIRECT$ = "HYACINTH" THEN STPCNT = 100
   IF PRCTKILL > 99.0 THEN STPCNT = PMDAYS * 1.1:GOTO PLOTGRAPH
   NEXT PMDAYS

PLOTGRAPH:
   PRCTKILL = LAGOO
   DKILDPMD = 0

PLOTGRAPH2:
   CLS
   LOCATE 12,5,0
```

```
    PRINT "When the Following Graph Has Finished Printing on";
    PRINT " the Screen, a Hardcopy"
    PRINT "    May be Obtained by Pressing and Holding the";
    PRINT " <SHIFT> Key and Then Pressing"
    PRINT"    the <Print Screen> or <PrtSc> Key";
    PRINT " (which ever your system has)."
    PRINT:PRINT"    This Should be Done";
    COLOR 4
    PRINT" BEFORE";
    COLOR 14,1
    PRINT " Pressing <ENTER> as Instructed on the at the"
    PRINT "    Bottom of the Graph."
    PRINT
    PRINT
    INPUT "                              Press <ENTER> to Continue";X$
    CLS
    SCREEN 1,0
    COLOR 0,0
    PRTPOS$ = STR$(DAYS)
    PRTPOS = LEN(PRTPOS$)
    PRTPOS = 37 - PRTPOS
    LOCATE 20,5,0
    PRINT "0           MG/KG-DAYS"
    LOCATE 20,PRTPOS,0
    PRINT USING "###.#";STPCNT
    LOCATE 2,2,0
    PRINT "100"
    LOCATE 10,2,0
    PRINT "%"
    LOCATE 11,1,0
    PRINT "kill"
    LINE (39,10)-(301,151),3,B
    CIRCLE (100,164),5,2
    LOCATE 21,15,0
    PRINT "=kill achieved"
    ITER = PMDAYS / 260
    IF STPCNT = 0 THEN STPCNT = ITER
    IF DIRECT$ <> "HYACINTH" THEN GOTO LOGISTIC

HYACINTH:
    ITER = 0.1
    STPCNT = 50
    FOR PMDAYSH = 0 TO STPCNT STEP ITER
    DKILDPMD = (99 * (1 - EXP(-RESPCO * PMDAYSH))) - INCR
    INCR = INCR + DKILDPMD
    PRCTKILL = PRCTKILL + DKILDPMD
    PMDAYS = PMDAYSH
    GOTO PUTPOINT

LOGISTIC:
    FOR PMDAYS = 0 TO STPCNT STEP ITER
    DKILDPMD = (RESPCO * PRCTKILL * ((99 - PRCTKILL) / 99)) * ITER
```

```
    PRCTKILL = PRCTKILL + DKILDPMD

PUTPOINT:
    Y = ((260 / STPCNT) * PMDAYS) + 40
    X = 150 - ((139 / 100) * PRCTKILL)
    PSET(Y,X),1
    IF PMDAYS < PPMDAYS OR CIRCREC = 1 THEN GOTO NEXTPPM
    CIRCREC = 1
    CIRCLE (Y,X),5,2
    KILLPCT = PRCTKILL

NEXTPPM:
    IF DIRECT$ = "HYACINTH" THEN GOTO NEXTPMDAYSH
    NEXT PMDAYS
    GOTO ENDLOOP

NEXTPMDAYSH:
    NEXT PMDAYSH

ENDLOOP:
    IF PPMDAYS > PMDAYS THEN CIRCLE(Y,X),5,2:KILLPCT = 100
    LOCATE 23,10,0
    INPUT "press <ENTER>";X$
    SCREEN 2
    SCREEN 0,1,0,0
    COLOR 14,1
    CLS
    CURBIOM = (1 - (KILLPCT / 100)) * INITBIOM
    IF UNITS$ = "M" THEN PRN$ = " Metric Tons/Hectare"
    IF UNITS$ = "S" THEN PRN$ = " Tons/Acre"
    IF KILLPCT > 99.0 THEN KILLPCT = 99.0
    LOCATE 12,1,0
    PRINT "                    percent kill is:";
    PRINT USING "###.##";KILLPCT
    PRINT ""
    PRINT "                    initial biomass was:";
    PRINT USING "###.##";INITBIOM;
    PRINT PRN$:PRINT ""
    PRINT "                    final biomass is:";
    PRINT USING "###.##";CURBIOM;
    PRINT PRN$
    PRINT:PRINT:PRINT:PRINT
    INPUT"                press <ENTER> to continue";X$
    CLOSE
    IF CURBIOM <= 0 THEN CURBIOM = INITBIOM / 1000
    DEF SEG=0:POKE 1050,PEEK(1052)
    CLS
    LOCATE 12,1,0
    PRINT " Would You Like to Repeat This Module or Continue to";
    PRINT " Module 3 (Plant Response)?"
    LOCATE 15,5,0
    PRINT"                Repeat                    Continue"
```

```
    LOCATE 23,15,0
    PRINT "MOVE CURSOR TO DESIRED SELECTION AND PRESS <ENTER>"
    LOCATE 15,21,0
    COLOR 19
    PRINT CHR$(178)
    REPCON$ = "REP"
    DEF SEG=0:POKE 1050,PEEK(1052)

CHOOSE1:
    CURSOR$ = INKEY$
    IF CURSOR$ = "" THEN GOTO CHOOSE1
    CURSOR$ = RIGHT$(CURSOR$,1)
    IF CURSOR$ = CHR$(13) THEN GOTO CHOSEN1
    IF CURSOR$ = CHR$(77) THEN GOTO CONTMOD
    IF CURSOR$ = CHR$(75) THEN GOTO REP
    GOTO CHOOSE1

REP:
    LOCATE 15,46,0
    PRINT" "
    LOCATE 15,21,0
    PRINT CHR$(178)
    REPCON$="REP"
    GOTO CHOOSE1

CONTMOD:
    LOCATE 15,21,0
    PRINT " "
    LOCATE 15,46,0
    PRINT CHR$(178)
    REPCON$ = "CONT"
    GOTO CHOOSE1

CHOSEN1:
    COLOR 14,1
    IF REPCON$ = "CONT" THEN GOTO MENU
    TIMESCHK = TIMESCHK + 1
    CLS
    LOCATE 12,5,0
    PRINT "        Would You Like to change to model parameters or not?"
    LOCATE 15,5,0
    PRINT "                    Change                    No Change"
    LOCATE 23,15,0
    PRINT "MOVE CURSOR TO DESIRED SELECTION AND PRESS <ENTER>"
    LOCATE 15,21,0
    COLOR 19
    PRINT CHR$(178)
    FIXCH$ = "CHNG"
    DEF SEG=0:POKE 1050,PEEK(1052)

CHOOSE2:
    CURSOR$ = INKEY$
```

```
    IF CURSOR$ = "" THEN GOTO CHOOSE2
    CURSOR$ = RIGHT$(CURSOR$,1)
    IF CURSOR$ = CHR$(13) THEN GOTO CHOSEN2
    IF CURSOR$ = CHR$(77) THEN GOTO NCHG
    IF CURSOR$ = CHR$(75) THEN GOTO CHNG
    GOTO CHOOSE2

CHNG:
    LOCATE 15,46,0
    PRINT " "
    LOCATE 15,21,0
    PRINT CHR$(178)
    FIXCH$ = "CHNG"
    GOTO CHOOSE2

NCHG:
    LOCATE 15,21,0
    PRINT " "
    LOCATE 15,46,0
    PRINT CHR$(178)
    FIXCH$ = "NCHG"
    GOTO CHOOSE2

CHOSEN2:
    COLOR 14,1
    CIRCREC = 0
    IF FIXCH$ = "NCHG" AND DIRECT$ = "HYACINTH" THEN GOTO PLOTGRAPH2
    IF FIXCH$ = "NCHG" THEN GOTO SKIPINSTR
    CLS
    LOCATE 3,25,0
    IF DIRECT$ = "HYACINTH" THEN GOTO HYACINTH2
    PRINT "The Model is in the Form:"
    PRINT
    COLOR 2
    PRINT "                                                    (-response";
    PRINT " coeff. X mg/kg-days)":
    PRINT"     percent kill= 99% / (1 + (1/lag coeff. X  e";
    PRINT "                              )"
    COLOR 14,1
    PRINT
    PRINT
    PRINT "        The response and lag coefficients can range";
    PRINT " from 0.1 to 1000."
    PRINT
    PRINT "The larger these coefficients, the faster the response";
    PRINT " and the longer the lag."
    PRINT
    PRINT "                current response coefficient is:";RESPCO
    PRINT
    PRINT "                current lag coefficient is:";LAGCOEF
    PRINT "_____________________________________________";
    PRINT "_____________________________________"
```

```
NEWRESPCO:
   PRINT
   INPUT "       enter new response coefficient ==>";RESPCO
   IF RESPCO > 0 AND RESPCO < 999 THEN GOTO NEWLAGCO
   PRINT "        value must be between 0.1 and 1000"
   GOTO NEWRESPCO

NEWLAGCO:
   PRINT
   INPUT "       enter new lag coefficient ==>";LAGCO
   IF RESPCO > 0 AND RESPCO < 999 THEN GOTO KEEPGOIN
   PRINT "        value must be between 0.1 and 1000"
   CIRCREC = 0
   GOTO NEWLAGCO

HYACINTH2:
   PRINT "The Model is in the Form:"
   PRINT
   COLOR 2
   PRINT "                                    (-response";
   PRINT " coeff. X mg/kg-days)":
   PRINT"     percent kill = (99% * (1 - e";
   PRINT "                                  )"
   COLOR 14,1
   PRINT
   PRINT
   PRINT "        The response coefficient can range";
   PRINT " from 0.01 to 1000."
   PRINT
   PRINT "        The larger this coefficient, the faster the response";
   PRINT
   PRINT "                current response coefficient is:";RESPCO
   PRINT
   PRINT "_____________________________________________";
   PRINT "_____________________________________"


NEWRESPCO2:
   PRINT
   INPUT "       enter new response coefficient ==>";RESPCO
   IF RESPCO > 0 AND RESPCO < 999 THEN GOTO KEEPGOIN
   PRINT "        value must be between 0.01 and 1000"
   GOTO NEWRESPCO2

KEEPGOIN:
   PRINT
   INPUT "              press <ENTER> to continue";X$
   CIRCREC = 0
   GOTO PLOTGRAPH2

MENU:
```

```
  CLOSE
  TITLE$ = "                              Module II (Effects) Menu"
  MENU$(1) = "1. Continue Program (Module III)"
  MENU$(2) = "2. Change / Review Data"
  MENU$(3) = "3. Save Data to Disk"
  MENU$(4) = "4. Load New Data File or Replace Defaults"
  MENU$(5) = "5. Restart Program From Beginning"
  MENU$(6) = "6. Help and Instructions"
  MENU$(7) = "7. Exit HERBICIDE Program"
  RESULT$(1) = "MODIII"
  RESULT$(2) = "ENTER"
  RESULT$(3) = "SAVE"
  RESULT$(4) = "INPUT"
  RESULT$(5) = "SELECT"
  RESULT$(6) = "HELP1"
  RESULT$(7) = "QUIT"
  MAXITEM = 7
  CHAIN PPATH$ + "MENU"

TRAP:
  SCREEN 2
  SCREEN 0,1,0,0
  COLOR 7,1
  CLS
  PRINT " ";TAB(30);"ERROR INFORMATION"
  COLOR 14,1
  PRINT "═══════════════════════════════════════";
  PRINT "═══════════════════════════════════════"
  DEF SEG=0:POKE 1050,PEEK(1052)
KNOWN:
  IF ERR < 24 THEN GOTO UNKNOWN
  IF ERR = 26 THEN GOTO UNKNOWN
  IF ERR > 27 AND ERR < 52 THEN GOTO UNKNOWN
  IF ERR > 53 AND ERR < 61 THEN GOTO UNKNOWN
  IF ERR > 61 AND ERR < 68 THEN GOTO UNKNOWN
  IF ERR = 69 THEN GOTO UNKNOWN
  IF ERR > 72 AND ERR < 76 THEN GOTO UNKNOWN
  IF ERR > 76 THEN GOTO UNKNOWN
  LOCATE 8,10,0
  PRINT "AN ERROR HAS OCCURRED DURING THE OPERATION OF THIS PROGRAM:"
  LOCATE 10,5,0
  IF ERR = 24 THEN PRINT "DISK DRIVE OR PRINTER IS NOT TURNED ON";
    IF ERR = 24 THEN PRINT "OR PLUGGED IN"
  IF ERR = 25 THEN PRINT "HARDWARE MALFUNCTION"
  IF ERR = 27 THEN PRINT "THE PRINTER IS OUT OF PAPER"
  IF ERR = 52 THEN PRINT "THE FILE NAME IS INVALID. RENAME THE FILE."
  IF ERR = 61 THEN PRINT "YOU WILL HAVE TO USE A NEW DISK. THIS ONE IS FULL"
  IF ERR = 68 THEN PRINT "TARGET DEVICE DOES NOT EXIST, THIS PROGRAM"
    IF ERR = 68 THEN PRINT "ATTEMPTED TO ACCESS A DISK DRIVE OR PRINTER"
    IF ERR = 68 THEN PRINT "WHICH IS NOT PRESENT. SOFTWARE MUST BE RE-"
    IF ERR = 68 THEN PRINT "CONFIGURED TO PERFORM THE REQUESTED ACTION"
  IF ERR = 70 THEN PRINT "THE DISK IS WRITE PROTECTED"
```

```
  IF ERR = 53 OR ERR = 76 THEN PRINT "PROBABLY THE WRONG DISK IS IN";
    IF ERR = 53 OR ERR = 76 THEN PRINT " THE DISK DRIVE."
  IF ERR = 71 THEN PRINT "EITHER THE DISK DRIVE DOOR IS OPEN OR THERE";
    IF ERR = 71 THEN PRINT " IS NO DISK IN THE DRIVE"
  IF ERR = 72 THEN PRINT "THE DISKETTE IS PROBABLY BAD. USE A NEW DISKETTE"
  GOTO PAUSE
UNKNOWN:
  LOCATE 10,5,0
  PRINT "AN ERROR HAS BEEN IDENTIFIED IN THIS PROGRAM. PLEASE CONTACT"
  LOCATE 11,5,0
  PRINT "YOUR SOFTWARE SUPPORT REPRESENTATIVE AND REPORT THAT ERROR"
  LOCATE 12,5,0
  PRINT "NUMBER";ERR;" OCCURRED IN SUB-ROUTINE: ";LINK$
  LOCATE 20,28,0
  COLOR 20
  PRINT "PRESS ANY KEY TO CONTINUE"
  COLOR 14,1
  GOTO SCAN
PAUSE:
  LOCATE 20,15,0
  COLOR 20
  PRINT "CORRECT THIS ERROR AND PRESS ANY KEY TO CONTINUE"
  COLOR 14,1
  CLOSE
SCAN:
  SEL$ = INKEY$
  IF SEL$ = "" THEN GOTO SCAN
  CLS
  RESUME BEGIN
```

Subroutine MODIII

```
START:
   DIM A$(24,2)
   DIM A(24,1)
   DIM F$(60)
   DIM B(25)
   DIM MENU$(10)
   DIM RESULT$(10)
   DIM FILESIN$(60)
   COMMON DSKID$,A$(),A(),F$(),B(),TYPE$,DIRECT$,UNITS$
   COMMON PPMDAYS,INITBIOM,DIR$,SPECNAME$,PERDRY
   COMMON CHEMNAME$,PRNTPLACE$,LINK$,PPATH$,DPATH$
   COMMON MENU$(),MAXITEM,RESULT$(),TITLE$,COUNT,CURBIOM
   LINK$ = "MODIII"
   CLS
   ON ERROR GOTO TRAP
   IF DSKID$ = "HD" THEN GOTO BEGIN

PRNTEXT:
   COLOR 14,1
   CLS
```

```
    LOCATE 12,5,0
    PRINT "Please Place the ";SPECNAME$;" Model Disk"
    LOCATE 14,5,0
    PRINT " in Drive ";PPATH$;" and Press any Key to Continue"

    CHKCHOOSE:
       SEL$=INKEY$
       IF SEL$="" THEN GOTO CHKCHOOSE

    OPEN PPATH$ + "DSKID.CHK" FOR INPUT AS #1
    INPUT #1,DSKID$
    CLOSE #1
    IF DSKID$ = DIRECT$ THEN GOTO BEGIN ELSE GOTO PRNTEXT

BEGIN:
    CHAIN PPATH$ + DIRECT$

TRAP:
   SCREEN 2
   SCREEN 0,1,0,0
   COLOR 7,1
   CLS
   PRINT " ";TAB(30);"ERROR INFORMATION"
   COLOR 14,1
   PRINT "═══════════════════════════════════════";
   PRINT "═══════════════════════════════════════"
   DEF SEG=0:POKE 1050,PEEK(1052)
KNOWN:
   IF ERR < 24 THEN GOTO UNKNOWN
   IF ERR = 26 THEN GOTO UNKNOWN
   IF ERR > 27 AND ERR < 52 THEN GOTO UNKNOWN
   IF ERR > 53 AND ERR < 61 THEN GOTO UNKNOWN
   IF ERR > 61 AND ERR < 68 THEN GOTO UNKNOWN
   IF ERR = 69 THEN GOTO UNKNOWN
   IF ERR > 72 AND ERR < 76 THEN GOTO UNKNOWN
   IF ERR > 76 THEN GOTO UNKNOWN
   LOCATE 8,10,0
   PRINT "AN ERROR HAS OCCURRED DURING THE OPERATION OF THIS PROGRAM:"
   LOCATE 10,5,0
   IF ERR = 24 THEN PRINT "DISK DRIVE OR PRINTER IS NOT TURNED ON";
     IF ERR = 24 THEN PRINT "OR PLUGGED IN"
   IF ERR = 25 THEN PRINT "HARDWARE MALFUNCTION"
   IF ERR = 27 THEN PRINT "THE PRINTER IS OUT OF PAPER"
   IF ERR = 52 THEN PRINT "THE FILE NAME IS INVALID. RENAME THE FILE."
   IF ERR = 61 THEN PRINT "YOU WILL HAVE TO USE A NEW DISK. THIS ONE IS FULL!"
   IF ERR = 68 THEN PRINT "TARGET DEVICE DOES NOT EXIST, THIS PROGRAM"
     IF ERR = 68 THEN PRINT "ATTEMPTED TO ACCESS A DISK DRIVE OR PRINTER"
     IF ERR = 68 THEN PRINT "WHICH IS NOT PRESENT. SOFTWARE MUST BE RE-"
     IF ERR = 68 THEN PRINT "CONFIGURED TO PERFORM THE REQUESTED ACTION"
   IF ERR = 70 THEN PRINT "THE DISK IS WRITE PROTECTED"
   IF ERR = 53 OR ERR = 76 THEN PRINT "PROBABLY THE WRONG DISK IS IN";
     IF ERR = 53 OR ERR = 76 THEN PRINT " THE DISK DRIVE."
```

```
  IF ERR = 71 THEN PRINT "EITHER THE DISK DRIVE DOOR IS OPEN OR THERE";
    IF ERR = 71 THEN PRINT " IS NO DISK IN THE DRIVE"
  IF ERR = 72 THEN PRINT "THE DISKETTE IS PROBABLY BAD. USE A NEW DISKETTE"
  GOTO PAUSE
UNKNOWN:
  LOCATE 10,5,0
  PRINT "AN ERROR HAS BEEN IDENTIFIED IN THIS PROGRAM. PLEASE CONTACT"
  LOCATE 11,5,0
  PRINT "YOUR SOFTWARE SUPPORT REPRESENTATIVE AND REPORT THAT ERROR"
  LOCATE 12,5,0
  PRINT "NUMBER";ERR;" OCCURRED IN SUB-ROUTINE: ";LINK$
  LOCATE 20,28,0
  COLOR 20
  PRINT "PRESS ANY KEY TO CONTINUE"
  COLOR 14,1
  GOTO SCAN
PAUSE:
  LOCATE 20,15,0
  COLOR 20
  PRINT "CORRECT THIS ERROR AND PRESS ANY KEY TO CONTINUE"
  COLOR 14,1
  CLOSE
SCAN:
  SEL$ = INKEY$
  IF SEL$ = "" THEN GOTO SCAN
  CLS
  RESUME START
```

Subroutine HYACINTH

```
BEGIN:
   DIM BIOM(365)
   DIM PT(365)
   DIM DAYC(14)
   DIM PRCTLF(14)
   DIM ATLWT(14)
   DIM ANLPT(14)
   DIM ANLPTA(14)
   DIM TEM(14)
   DIM FEEDB(365)
   DIM A$(24,2)
   DIM A(24,1)
   DIM F$(60)
   DIM B(25)
   DIM MENU$(10)
   DIM RESULT$(10)
   COMMON DSKID$,A$(),A(),F$(),B(),TYPE$,DIRECT$,UNITS$
   COMMON PPMDAYS,INITBIOM,DIR$,SPECNAME$,PERDRY
   COMMON CHEMNAME$,PRNTPLACE$,LINK$,PPATH$,DPATH$
   COMMON MENU$(),MAXITEM,RESULT$(),TITLE$,COUNT,CURBIOM
   LINK$ = "HYACINTH"
   ON ERROR GOTO TRAP
```

```
    SCREEN 0,1,0,0
    COLOR 14,1
    CLS
    IF DSKID$ = "HD" THEN GOTO START
    OPEN PPATH$ + "DSKID.CHK" FOR INPUT AS #1
    INPUT #1,DSKID$
    CLOSE #1
    IF DSKID$ = DIRECT$ THEN GOTO START
    CLS
    LOCATE 12,15,0
    PRINT"Please Place Program Disk 1 in Drive ";PPATH$
    LOCATE 14,15,0
    PRINT"and Press Any Key to Continue"

CHKCHOOSE:
    SEL$=INKEY$
    IF SEL$="" THEN GOTO CHKCHOOSE
    CLS
    GOTO START

START:
    IF UNITS$ <> "M" THEN GOTO CUSTOMARY
    CONVERT = 10
    PRNTHEAD$ = "MET. TONS/HA."
    AXIS = 600
    GOTO TITLES

CUSTOMARY:
    CONVERT = 4.4534
    PRNTHEAD$ = "TONS/ACRE"
    AXIS = 300

TITLES:
    PERWET = 1 / (PERDRY / 100)
    CURBIOM = (CURBIOM / CONVERT) / PERWET
    PRINT
    PRINT
    PRINT
    PRINT"              THIS PROGRAM WAS ADAPTED FROM THE ORIGINAL PROGRAM:"
    PRINT
    PRINT"               COMPUTER-SIMULATION MODELING OF Neochetina spp. --"
    PRINT"                    STRATEGIES TO CONTROL WATERHYACINTH"
    PRINT
    PRINT"                                  WRITTEN BY:"
    PRINT
    PRINT"             Kunter S. Akbay, Ph.D ,  Jean W. Wooten, Ph.D  and"
    PRINT"                              Fred G. Howell, Ph.D"
    PRINT
    PRINT"                 at the University of Southern Mississippi"
    PRINT
    PRINT"           SIMULATION FOR WEEVIL DAMAGE TO PLANTS HAS BEEN";
    PRINT " OMITTED"
```

```
    PRINT"          AND ONLY THE GROWTH PORTION OF THE MODEL HAS";
    PRINT " BEEN RETAINED."
    PRINT
    PRINT
    PRINT
    PRINT
    INPUT"                                PRESS <ENTER> TO BEGIN";X$

SKIPTITLE:
    GOSUB INPUTSUB
    FOR YRCNT = 0 TO YEARS
    RESTORE
    IF YRCNT > 0 THEN JDFRST = 1
    IF YRCNT = YEARS THEN JDLAST = ADD2 + D2
    GOSUB INITVAR
    GOSUB INITPLANT
    IF YRCNT > 0 THEN GOTO SEASON
    '****************** SELECT output TYPE ******************************
    CLS
    COLOR 14,1
    LOCATE 12,5,0
    PRINT "             Would You Like numerical or graphic output?"
    LOCATE 15,5,0
    PRINT "                    Graphic                    Numeric"
    LOCATE 23,15,0
    PRINT "MOVE CURSOR TO DESIRED SELECTION AND PRESS <ENTER>"
    LOCATE 19,2,0
    PRINT "NOTE: AT THE END OF THIS MODULE, YOU WILL BE GIVEN";
    PRINT " THE OPTION OF RE-RUNNING"
    LOCATE 20,5,0
    PRINT "THIS MODULE. TO OBTAIN BOTH NUMERICAL AND GRAPHIC OUTPUT,";
    PRINT " THIS MODULE"
    LOCATE 21,5,0
    PRINT "MUST BE RUN TWICE, ONCE WITH EACH OPTION."
    LOCATE 15,21,0
    COLOR 19
    PRINT CHR$(178)
    OUTTYPE$ = "GRAPH"
    DEF SEG=0:POKE 1050,PEEK(1052)

CHOOSE1:
    CURSOR$ = INKEY$
    IF CURSOR$ = "" THEN GOTO CHOOSE1
    CURSOR$ = RIGHT$(CURSOR$,1)
    IF CURSOR$ = CHR$(13) THEN GOTO PICKOUT
    IF CURSOR$ = CHR$(77) THEN GOTO NUMOUT
    IF CURSOR$ = CHR$(75) THEN GOTO GRAPHOUT
    GOTO CHOOSE1

GRAPHOUT:
    LOCATE 15,46,0
    PRINT" "
```

```
    LOCATE 15,21,0
    PRINT CHR$(178)
    OUTTYPE$ = "GRAPH"
    GOTO CHOOSE1

NUMOUT:
    LOCATE 15,21,0
    PRINT " "
    LOCATE 15,46,0
    PRINT CHR$(178)
    OUTTYPE$ = "NUM"
    GOTO CHOOSE1

PICKOUT:
    COLOR 14,1
    IF OUTTYPE$ = "GRAPH" THEN GOSUB PRNTGRAPH
    IF OUTTYPE$ = "GRAPH" THEN GOTO SEASON
    '****************** SELECT output device ***************************
    CLS
    LOCATE 12,5,0
    PRINT "  Would You Like the output to go to the screen or the printer?"
    LOCATE 15,5,0
    PRINT "                    Screen                    Printer"
    LOCATE 23,15,0
    PRINT "MOVE CURSOR TO DESIRED SELECTION AND PRESS <ENTER>"
    LOCATE 15,21,0
    COLOR 19
    PRINT CHR$(178)
    PRN$ = "SCRN:"
    DEF SEG=0:POKE 1050,PEEK(1052)

CHOOSE2:
    CURSOR$ = INKEY$
    IF CURSOR$ = "" THEN GOTO CHOOSE2
    CURSOR$ = RIGHT$(CURSOR$,1)
    IF CURSOR$ = CHR$(13) THEN GOTO CHOSEN2
    IF CURSOR$ = CHR$(77) THEN GOTO PRINTOUT
    IF CURSOR$ = CHR$(75) THEN GOTO SCREENOUT
    GOTO CHOOSE2

SCREENOUT:
    LOCATE 15,46,0
    PRINT " "
    LOCATE 15,21,0
    PRINT CHR$(178)
    PRN$ = "SCRN:"
    GOTO CHOOSE2

PRINTOUT:
    LOCATE 15,21,0
    PRINT " "
    LOCATE 15,46,0
```

```
    PRINT CHR$(178)
    PRN$ = "LPT1:"
    GOTO CHOOSE2

CHOSEN2:
    COLOR 14,1
    OPEN PRN$ FOR OUTPUT AS #1
    CLS
    IF PRNTPLACE$ = "LPT1:" THEN PRNTFIX = 0 ELSE PRNTFIX = 1

SEASON:
    '******** SIMULATE FOR THE SEASON *********
    IF OUTTYPE$ = "GRAPH" THEN GOTO SETDAY
    CLS
    PRINT #1, "                    WEATHER DATA SET SELECTED IS: ";WEATH$(NA)
    PRINT #1, "                              JULIAN              BIOMASS"
    PRINT #1, "                               DATE              ";PRNTHEAD$
    PRINT #1, ""
    IF YRCNT <> 0 THEN GOTO YEARNOT
    PRINT #1,"                                 ";
    PRINT #1,USING "###";ADD1 + D1;Y1;
    PRINT #1, "              ";
    PRINT #1, USING "###.##";(CURBIOM * PERWET) * CONVERT

YEARNOT:
    IF YRCNT <= 0 THEN GOTO SETDAY
    PRINT #1,"                                 ";
    PRINT #1,USING "###";JDFRST;Y1 + YRCNT;
    PRINT #1,"              ";
    PRINT #1,USING "###.##";(FINBIO * PERWET) * CONVERT

SETDAY:
    JDF1 = JDFRST + 1
    FOR JDAY = JDF1 TO JDLAST
    DAY = JDAY
    IDAY = JDAY - JDFRST + 1
    '************ READ DAILY WEATHER DATA **********
    INPUT #2,JWDAY,SOLR,TMAX,TMIN
    ATEMP = (TMAX + TMIN) / 2
    ATEMP = (ATEMP - 32) * (5 / 9)
    GOSUB MAXPHOTO
    GOSUB MODULUS
    KOUNT = MD
    IF OUTTYPE$ = "GRAPH" THEN GOTO CHECKGRAPH
    IF KOUNT <> 0 THEN GOTO SETBIO
    LOCATE 24,1,0
    IF PRN$ <> "LPT1:" THEN PRINT " ";TAB(20);
    IF PRN$ <> "LPT1:" THEN INPUT "PRESS <ENTER> TO CONTINUE";X$

CHECKGRAPH:
    IF KOUNT <> 0 THEN GOTO SETBIO
    IF OUTTYPE$ = "GRAPH" THEN GOTO CHECKNUM
```

```
   IF PRN$ = "LPT1:" THEN GOTO SETBIO
   CLS
   PRINT #1,"                              JULIAN              BIOMASS"
   PRINT #1,"                               DATE              ";PRNTHEAD$
   PRINT #1,""

SETBIO:
   IF YRCNT > 0 AND JDFRST = 1 AND JDAY = 1 THEN BIOMKG = FINBIO
   IF YRCNT > 0 AND JDFRST = 1 AND JDAY = 1 THEN GOTO CHKINCRQDAY
   BIOMKG = BIOM(IDAY) / 1000

CHKINCRQDAY:
   IF OUTTYPE$ = "GRAPH" THEN GOTO INCRQDAY
   PRINT #1,"                                 ";
   PRINT #1,USING "###";JDAY;
   PRINT #1,USING "###";Y1 + YRCNT;
   PRINT #1,"             ";
   PRINT #1,USING "###.##";(BIOMKG * PERWET) * CONVERT

CHECKNUM:
   IF OUTTYPE$ = "NUM" THEN GOTO NEXTJDAY

INCRQDAY:
   QDAY = QDAY + 1
   Y = ((260 / DAYS) * QDAY)+40
   X = 150 - ((140 / AXIS) * (BIOMKG * PERWET * CONVERT))
   PSET(Y,X),1

NEXTJDAY:
   NEXT JDAY
   CLOSE #2
   FINBIO = BIOM(IDAY) / 1000
   LOCATE 24,1,0
   IF OUTTYPE$ = "GRAPH" THEN GOTO NEXTYR
   IF PRN$ <> "LPT1:" THEN PRINT " ";TAB(20);
   IF PRN$ <> "LPT1:" THEN INPUT "PRESS <ENTER> TO CONTINUE";X$

NEXTYR:
   NEXT YRCNT
   DEF SEG=0:POKE 1050,PEEK(1052)
   LOCATE 23,8,0
   IF OUTTYPE$ = "GRAPH" THEN INPUT "PRESS <ENTER>";X$
   CLOSE #1
   QDAY = 0
   GOTO SETTIMES

TABLI:
   '************* FUNCTION TABLI *************
   K = 14
   DUMMY = DAY
   IF DUMMY < DAYC(K) THEN AMIN1 = DUMMY ELSE AMIN1 = DAYC(K)
   IF AMIN1 > DAYC(1) THEN AMAX1 = AMIN1 ELSE AMAX1 = DAYC(1)
```

```
    DUM = AMAX1
    FOR I = 2 TO K
      IF (DUM > DAYC(I)) THEN GOTO NEXTTABLI ELSE GOTO EXITI

NEXTTABLI:
    NEXT I

EXITI:
    J = I - 1
    TABLI = (DUM - DAYC(J)) * (TEM(I) - TEM(J))
    TABLI = TABLI / (DAYC(I) - DAYC(J)) + TEM(J)
    RETURN

INITVAR:
    '********** INITIALIZE VARIABLES ************
    FOR I = 1 TO 365
      PT(I) = 0
      BIOM(I) = 0
    NEXT I
    FOR I = 1 TO 14
      READ DAYC(I)
    NEXT I
    DATA 1,15,46,74,105,135,166,196,227,258,288,319,349,365
    FOR I = 1 TO 14
      READ PRCTLF(I)
    NEXT I
    DATA 0.2740,0.2740,0.2173,0.4076,0.6378,0.6569,0.7127
    DATA 0.7469,0.7056,0.6972,0.7292,0.7258,0.5944,0.2740
    FOR I = 1 TO 14
      READ ATLWT(I)
    NEXT I
    DATA 1.635,1.635,1.048,1.975,1.948,4.55,11.80,12.66
    DATA 12.73,15.97,14.23,9.15,5.41,3.523
    FOR I = 1 TO 14
      READ ANLPT(I)
    NEXT I
    DATA 3.95,4.1,4.21,4.81,4.63,6.2,6.46,6.33,5.81,6.31
    DATA 5.08,5.07,4.33,4.02
    FOR I = 1 TO 14
      READ ANLPTA(I)
    NEXT I
    DATA 3.125,2.75,5,6,6,6,6,6,6,6,6,5,3.5,3.125
    DAY   = 0
    SOLR  = 0
    TMAX  = 0
    TMIN  = 0
    ATEMP = 0
    KODE  = 0
    IDAY  = 0
    RM2   = 0.015
    RM1   = 0.019
    E     = 0.75
```

```
    FON    = 1
    FP     = 1
    KODEF  = 1
    CONVEX = 1
    DENSTY = 0
    PRCTLV = 0
    ATLW   = 0
    ANLP   = 0
    ANPLTS = 0
    DETLF  = 0
    REMORT = 0.001
    RLMORT = 0.001
    RPMORT = 0.001
    RAMORT = 0.001
    DUMMY  = 0
    DAY    = 0
    AMIN1  = 0
    AMAX   = 0
    DUM    = 0
    TABLI  = 0
    RETURN

MODULUS:
    '********** MODULUS PROCEDURE ************
    MD = IDAY / 20
    MD = MD - INT(MD)
    RETURN

INITPLANT:
    '********* INITIALIZE PLANT MODULE *********
    IF YRCNT <> 0 THEN GOTO SKIPNOTE
    CLS
    LOCATE 12,20,0
    PRINT "DATA IS BEING LOADED, PLEASE WAIT"

SKIPNOTE:
    IF YRCNT = 0 THEN BIOM(1) = CURBIOM ELSE BIOM(1) = FINBIO
    BIOM(1) = BIOM(1) * 1000
    DAY = JDFRST
    FOR I = 1 TO 14
      TEM(I) = PRCTLF(I)
    NEXT I
    GOSUB TABLI
    PRCTLV = TABLI
    FOR I = 1 TO 14
      TEM(I) = ATLWT(I)
    NEXT I
    GOSUB TABLI
    ATLW = TABLI
    IF WDATA$ = "W75F.DAT" THEN GOTO SETTEM
    FOR I = 1 TO 14
      ANLPT(I) = ANLPTA(I)
```

```
    NEXT I

SETTEM:
    FOR I = 1 TO 14
      TEM(I) = ANLPT(I)
    NEXT I
    GOSUB TABLI
    ANLP = TABLI
    OPEN DPATH$ + DIRECT$ + "\" + WDATA$ FOR INPUT AS #2

GETWEAT:
    INPUT#2,JWDAY,SOLR,TMAX,TMIN
    IF JWDAY < JDFRST THEN GOTO GETWEAT
    RETURN

MAXPHOTO:
    '********* MAXIMUM PHOTOSYNTHESIS ************
    IF SOLR > 100 THEN GOTO SETPMAX
    PMAX = 0.32 * SOLR
    GOTO TEMPLIMIT

SETPMAX:
    PMAX = 22.318 + 0.102 * SOLR

TEMPLIMIT:
    '********* TEMPERATURE LIMITING FUNCTION - PHOTOSYNTHESIS ******
    ATEMP1 = ABS(ATEMP - 29)
    FT = 1 - 0.0037 * ATEMP1^2
    IF FT < 0 THEN FT = 0.028
    '******** DENSITY LIMITING FUNCTION - PHOTOSYNTHESIS ***********
    DENSTY = BIOM(IDAY - 1)
    IF DENSTY >= 1000 THEN GOTO SETFDEN
    FDEN = DENSTY / 1000
    GOTO SETGROSS

SETFDEN:
    FDEN = 1

SETGROSS:
    '******** GROSS PHOTOSYNTHESIS ***********
    PG = PMAX * FT * FON * FP * FDEN
    '******** DETRITAL PRODUCTION ************
    FOR I = 1 TO 14
      TEM(I) = PRCTLF(I)
    NEXT I
    GOSUB TABLI
    PRCTLV = TABLI
    FOR I = 1 TO 14
      TEM(I) = ATLWT(I)
    NEXT I
    GOSUB TABLI
    ATLW = TABLI
```

```
   FOR I = 1 TO 14
     TEM(I) = ANLPT(I)
   NEXT I
   GOSUB TABLI
   ANLP = TABLI
   ANPLTS = (DENSTY * PRCTLV) / ATLW
   DRATEL = 1 / 10.2
   DETLF = ANPLTS * DRATEL
   D = DETLF * (ATLW / ANLP)
   '******* RESPIRATORY MAINTENANCE BY GEOGRAPHICAL LOCALITY ****
   IF NA > 4 THEN GOTO FLORIDA
   '******* FOR LOUISIANA ***********
   RM = RM2 * DENSTY
   GOTO EFFICIENT

FLORIDA:
   '******* FOR FLORIDA *************
   RM = RM1 * DENSTY

EFFICIENT:
   '******* CHOOSE EFFICIENCY BASED ON WHETHER PLANTS ARE FLOWERING
   IF NA > 4 THEN GOTO FLORIDA2
   '******* FOR LOUISIANA ***********
   IF JDAY > 150 AND JDAY < 330 THEN E = 0.73 ELSE E = 0.83
   GOTO GROWTH

FLORIDA2:
   '******* FOR FLORIDA *************
   IF JDAY > 150 AND JDAY < 330 THEN E = 0.65 ELSE E = 0.75

GROWTH:
   '******* WATERHYACINTH GROWTH IN DRY WEIGHT PER DAY
   '******* BASED ON WHETHER OR NOT DETRITUS IS INCLUDED
   IF NA <= 4 THEN DLTBM = ((PG - RM) * E)
   IF NA > 4 THEN DLTBM = ((PG - RM * E) - D)
   IF ATEMP <= 0 THEN DLTBM = -D
   '******* CUMULATIVE BIOMASS **********
   BIOM(IDAY) = BIOM(IDAY - 1) + DLTBM
   RETURN

PRNTGRAPH:
   CLS
   COLOR 14,1
   LOCATE 12,5,0
   PRINT "When the Following Graph Has Finished Printing on the";
   PRINT " Screen, a Hardcopy"
   PRINT "    May be Obtained by Pressing and Holding the <SHIFT>";
   PRINT " Key and Then Pressing"
   PRINT "    the <Print Screen> or <PrtSc> Key (whichever";
   PRINT " your system has)."
   PRINT
   PRINT "    This Should be Done";
```

```
    COLOR 4
    PRINT " BEFORE";
    COLOR 14,1
    PRINT " Pressing <ENTER> as Instructed on the at the"
    PRINT "    Bottom of the Graph."
    PRINT
    PRINT
    INPUT "                              Press <ENTER> to Continue";X$
    CLS
    SCREEN 1,0
    COLOR 0,0
    PRTPOS$ = STR$(DAYS)
    PRTPOS = LEN(PRTPOS$)
    PRTPOS = 37 - PRTPOS
    LOCATE 20,2,0
    PRINT USING "###";M1;D1;Y1;
    PRINT "          Date        ";
    PRINT USING "###";M2;D2;Y2
    IF UNITS$ <> "S" THEN GOTO METRICOUT
    LOCATE 1,2,0
    PRINT "300"
    LOCATE 10,1,0
    PRINT "TONS"
    LOCATE 11,1,0
    PRINT "PER"
    LOCATE 12,1,0
    PRINT "ACRE"
    GOTO PRINTGRAPH

METRICOUT:
    LOCATE 1,2,0
    PRINT "600"
    LOCATE 9,1,0
    PRINT "MET."
    LOCATE 10,1,0
    PRINT "TONS"
    LOCATE 11,1,0
    PRINT "PER"
    LOCATE 12,1,0
    PRINT "HA."

PRINTGRAPH:
    LINE (39,1)-(301,151),3,B
    DEF SEG=0:POKE 1050,PEEK(1052)
    CIRCLE (44,150 - ((140 / AXIS) * INITBIOM)),5,2
    CIRCLE (88,164),5,2
    LOCATE 21,13,0
    PRINT "=PRE-TREATMENT BIOMASS"
    RETURN

SETTIMES:
    TIMESTHRU = 1
```

```
   '****************** RE DO MODULE 3 OR NOT ***************************
   SCREEN 2
   SCREEN 0,1,0,0
   COLOR 14,1
   CLS
   LOCATE 12,5,0
   PRINT "                  Would You Like to re-run this module?"
   LOCATE 15,5,0
   PRINT "                    Yes                          No"
   LOCATE 23,15,0
   PRINT "MOVE CURSOR TO DESIRED SELECTION AND PRESS <ENTER>"
   LOCATE 15,21,0
   COLOR 19
   PRINT CHR$(178)
   SEL$ = "YES"
   DEF SEG=0:POKE 1050,PEEK(1052)

CHOOSE3:
   CURSOR$ = INKEY$
   IF CURSOR$ = "" THEN GOTO CHOOSE3
   CURSOR$ = RIGHT$(CURSOR$,1)
   IF CURSOR$ = CHR$(13) THEN GOTO CHOSEN3
   IF CURSOR$ = CHR$(77) THEN GOTO NO
   IF CURSOR$ = CHR$(75) THEN GOTO YES
   GOTO CHOOSE3

YES:
   LOCATE 15,46,0
   PRINT " "
   LOCATE 15,21,0
   PRINT CHR$(178)
   SEL$ = "YES"
   GOTO CHOOSE3

NO:
   LOCATE 15,21,0
   PRINT " "
   LOCATE 15,46,0
   PRINT CHR$(178)
   SEL$ = "NO"
   GOTO CHOOSE3

CHOSEN3:
   COLOR 14,1
   CLOSE
   IF SEL$ = "YES" THEN GOTO SKIPTITLE
   GOTO QUIT

INPUTSUB:
   SCREEN 2
   SCREEN 0,1,0,0
   COLOR 14,1
```

```
   CLS
   LOCATE 10,19,0
   PRINT"Enter Date Of Treatment (MM/DD/YY) ==> __/ __/ __"
   LOCATE 15,7,0
   PRINT "Enter Last Day To Observe Plant Response (MM/DD/YY)";
   PRINT " ==> __/ __/ __"
   LOCATE 21,2,0
   PRINT "Enter Requested Dates in the Form: Month Month / Day Day";
   PRINT " / Year Year."
   LOCATE 22,2,0
   PRINT "Example: June Second 1984 Would be Entered as: 06 / 02 /";
   PRINT " 84. Use the Cursor"
   LOCATE 23,2,0
   PRINT "Arrows to Move to Appropriate Blanks and When Date is";
   PRINT " Correct, Press <ENTER>."
   COLOR 3
   LOCATE 10,58,0
   PRINT "00"
   LOCATE 10,62,0
   PRINT "00"
   LOCATE 10,66,0
   PRINT "00"
   LOCATE 15,63,0
   PRINT "00"
   LOCATE 15,67,0
   PRINT "00"
   LOCATE 15,71,0
   PRINT "00"
   COLOR 14,1
   ARCOL = 58
   ARROW = 9

INITSCREEN:
   LOCATE ARROW,ARCOL,0
   COLOR 22
   PRINT CHR$(25)

CHOOSE4:
   SEL$ = INKEY$
   IF SEL$ = "" THEN GOTO CHOOSE4
   DEF SEG=0:POKE 1052,PEEK(1050)
   SEL$ = RIGHT$(SEL$,1)
   MOVE$ = ""
   LOCATE ARROW,ARCOL,0
   PRINT CHR$(32)
   IF SEL$ = CHR$(75) OR SEL$ = CHR$(8) THEN MOVE$ = "LEFT"
   IF MOVE$ = "LEFT" THEN ARCOL = ARCOL - 1
   IF SEL$ = CHR$(72) THEN ARROW = ARROW - 5
   IF SEL$ = CHR$(77) OR SEL$ = CHR$(32) THEN MOVE$ = "RIGHT"
   IF MOVE$ = "RIGHT" THEN ARCOL = ARCOL + 1
   IF SEL$ = CHR$(80) THEN ARROW = ARROW + 5
   IF SEL$ > CHR$(47) AND SEL$ < CHR$(58) THEN GOTO PRINTARROW
```

```
    IF SEL$ = CHR$(13) THEN GOTO GETSCREEN
    IF ARROW < 9 THEN ARROW = 9
    IF ARROW > 14 THEN ARROW = 14
    IF ARROW = 9 AND SEL$ = CHR$(72) THEN ARCOL = 58
    IF ARROW = 14 AND SEL$ = CHR$(80) THEN ARCOL = 63
    IF ARROW = 14 AND ARCOL < 63 THEN ARCOL = 63
    IF ARROW=9 AND ARCOL<58 THEN ARCOL = 58
    IF ARROW=9 AND ARCOL>59 AND ARCOL<62 AND MOVE$="RIGHT" THEN ARCOL=62
    IF ARROW=9 AND ARCOL>59 AND ARCOL<62 AND MOVE$="LEFT" THEN ARCOL=59
    IF ARROW=9 AND ARCOL>63 AND ARCOL<66 AND MOVE$="RIGHT" THEN ARCOL=66
    IF ARROW=9 AND ARCOL>63 AND ARCOL<66 AND MOVE$="LEFT" THEN ARCOL=63
    IF ARROW=14 AND ARCOL>64 AND ARCOL<67 AND MOVE$="RIGHT" THEN ARCOL=67
    IF ARROW=14 AND ARCOL>64 AND ARCOL<67 AND MOVE$="LEFT" THEN ARCOL=64
    IF ARROW=14 AND ARCOL>68 AND ARCOL<71 AND MOVE$="RIGHT" THEN ARCOL=71
    IF ARROW=14 AND ARCOL>68 AND ARCOL<71 AND MOVE$="LEFT" THEN ARCOL=68
    IF ARROW=9 AND ARCOL>67 THEN ARCOL=67
    IF ARROW=14 AND ARCOL>72 THEN ARCOL=72
    GOTO INITSCREEN

PRINTARROW:
    LOCATE ARROW + 1,ARCOL,0
    PRINT CHR$(32)
    COLOR 3
    LOCATE ARROW + 1,ARCOL,0
    PRINT SEL$
    COLOR 22
    ARCOL = ARCOL + 1
    IF ARROW=9 AND ARCOL<58 THEN ARCOL=58
    IF ARROW=9 AND ARCOL>67 THEN ARROW=14:ARCOL=63
    IF ARROW=9 AND ARCOL>59 AND ARCOL<62 THEN ARCOL=62
    IF ARROW=9 AND ARCOL>63 AND ARCOL<66 THEN ARCOL=66
    IF ARROW=14 AND ARCOL>64 AND ARCOL<67 THEN ARCOL=67
    IF ARROW=14 AND ARCOL>68 AND ARCOL<71 THEN ARCOL=71
    IF ARROW=14 AND ARCOL<63 THEN ARCOL=63
    IF ARROW=14 AND ARCOL>72 THEN ARROW=9:ARCOL=58
    GOTO INITSCREEN

GETSCREEN:
    M1=VAL((CHR$(SCREEN(10,58)))+(CHR$(SCREEN(10,59))))
    D1=VAL((CHR$(SCREEN(10,62)))+(CHR$(SCREEN(10,63))))
    Y1=VAL((CHR$(SCREEN(10,66)))+(CHR$(SCREEN(10,67))))
    M2=VAL((CHR$(SCREEN(15,63)))+(CHR$(SCREEN(15,64))))
    D2=VAL((CHR$(SCREEN(15,67)))+(CHR$(SCREEN(15,68))))
    Y2=VAL((CHR$(SCREEN(15,71)))+(CHR$(SCREEN(15,72))))
    COLOR 6
    IF M1 >= 1 AND M1 <= 12 THEN GOTO ENDMONTH
    LOCATE 18,3,0
    INPUT "Treatment Month is Invalid, Press <ENTER> to Continue";X$
    LOCATE 18,3,0
    PRINT" ";TAB(80);" ";
    ARROW = 9
    ARCOL = 58
```

```
   GOTO INITSCREEN

ENDMONTH:
   IF M2 >= 1 AND M2 <= 12 THEN GOTO CHECKYEAR
   LOCATE 18,3,0
   INPUT "Ending Month is Invalid, Press <ENTER> to Continue";X$
   LOCATE 18,3,0
   PRINT" ";TAB(80);" ";
   ARROW = 14
   ARCOL = 63
   GOTO INITSCREEN

CHECKYEAR:
   IF Y2 > Y1 THEN GOTO CHECKMONTH
   IF Y2 = Y1 AND M2 > M1 THEN GOTO CHECKMONTH
   IF Y2 >= Y1 THEN GOTO CHECKEND
   LOCATE 18,3,0
   PRINT "Ending Date Must be Greater Than Treatment Date. Press";
   INPUT " <ENTER> to Continue";X$
   LOCATE 18,3,0
   PRINT " ";TAB(80);" ";
   ARROW = 14
   ARCOL = 63
   GOTO INITSCREEN

CHECKEND:
   IF M2 >= M1 THEN GOTO CHECKTREAT
   LOCATE 18,3,0
   PRINT "Ending Date Must be Greater Than Treatment Date. Press";
   INPUT " <ENTER> to Continue";X$
   LOCATE 18,3,0
   PRINT " ";TAB(80);" ";
   ARROW = 14
   ARCOL = 63
   GOTO INITSCREEN

CHECKTREAT:
   IF D2 > D1 THEN GOTO CHECKMONTH
   LOCATE 18,3,0
   PRINT "Ending Date Must be Greater Than Treatment Date. Press";
   INPUT " <ENTER> to Continue";X$
   LOCATE 18,3,0
   PRINT " ";TAB(80);" ";
   ARROW = 14
   ARCOL = 63
   GOTO INITSCREEN

CHECKMONTH:
   IF M1 <> 1 THEN GOTO FEB1
   MONTH$ = "January"
   TOTDAYS = 31
   ARROW = 9
```

```
   ARCOL = 62
   IF D1 < 1 OR D1 > TOTDAYS THEN GOTO FLAGDATE

FEB1:
   IF M1 <> 2 THEN GOTO MAR1
   MONTH$ = "February"
   TOTDAYS = 28
   ARROW = 9
   ARCOL = 62
   IF D1 < 1 OR D1 > TOTDAYS THEN GOTO FLAGDATE

MAR1:
   IF M1 <> 3 THEN GOTO APR1
   MONTH$ = "March"
   TOTDAYS = 31
   ARROW = 9
   ARCOL = 62
   IF D1 < 1 OR D1 > TOTDAYS THEN GOTO FLAGDATE

APR1:
   IF M1 <> 4 THEN GOTO MAY1
   MONTH$ = "April"
   TOTDAYS = 30
   ARROW = 9
   ARCOL = 62
   IF D1 < 1 OR D1 > TOTDAYS THEN GOTO FLAGDATE

MAY1:
   IF M1 <> 5 THEN GOTO JUN1
   MONTH$ = "May"
   TOTDAYS = 31
   ARROW = 9
   ARCOL = 62
   IF D1 < 1 OR D1 > TOTDAYS THEN GOTO FLAGDATE

JUN1:
   IF M1 <> 6 THEN GOTO JUL1
   MONTH$ = "June"
   TOTDAYS = 30
   ARROW = 9
   ARCOL = 62
   IF D1 < 1 OR D1 > TOTDAYS THEN GOTO FLAGDATE

JUL1:
   IF M1 <> 7 THEN GOTO AUG1
   MONTH$ = "July"
   TOTDAYS = 31
   ARROW = 9
   ARCOL = 62
   IF D1 < 1 OR D1 > TOTDAYS THEN GOTO FLAGDATE

AUG1:
```

```
    IF M1 <> 8 THEN GOTO SEP1
    MONTH$ = "August"
    TOTDAYS = 31
    ARROW = 9
    ARCOL = 62
    IF D1 < 1 OR D1 > TOTDAYS THEN GOTO FLAGDATE

SEP1:
    IF M1 <> 9 THEN GOTO OCT1
    MONTH$ = "September"
    TOTDAYS = 30
    ARROW = 9
    ARCOL = 62
    IF D1 < 1 OR D1 > TOTDAYS THEN GOTO FLAGDATE

OCT1:
    IF M1 <> 10 THEN GOTO NOV1
    MONTH$ = "October"
    TOTDAYS = 31
    ARROW = 9
    ARCOL = 62
    IF D1 < 1 OR D1 > TOTDAYS THEN GOTO FLAGDATE

NOV1:
    IF M1 <> 11 THEN GOTO DEC1
    MONTH$ = "November"
    TOTDAYS = 31
    ARROW = 9
    ARCOL = 62
    IF D1 < 1 OR D1 > TOTDAYS THEN GOTO FLAGDATE

DEC1:
    MONTH$ = "December"
    TOTDAYS = 31
    ARROW = 9
    ARCOL = 62
    IF D1 < 1 OR D1 > TOTDAYS THEN GOTO FLAGDATE

JAN2:
    IF M2 <> 1 THEN GOTO FEB2
    MONTH$ = "January"
    TOTDAYS = 31
    ARROW = 14
    ARCOL = 67
    IF D2 < 1 OR D2 > TOTDAYS THEN GOTO FLAGDATE

FEB2:
    IF M2 <> 2 THEN GOTO MAR2
    MONTH$ = "February"
    TOTDAYS = 28
    ARROW = 14
    ARCOL = 67
```

```
   IF D2 < 1 OR D2 > TOTDAYS THEN GOTO FLAGDATE

MAR2:
   IF M2 <> 3 THEN GOTO APR2
   MONTH$ = "March"
   TOTDAYS = 31
   ARROW = 14
   ARCOL = 67
   IF D2 < 1 OR D2 > TOTDAYS THEN GOTO FLAGDATE

APR2:
   IF M2 <> 4 THEN GOTO MAY2
   MONTH$ = "April"
   TOTDAYS = 30
   ARROW = 14
   ARCOL = 67
   IF D2 < 1 OR D2 > TOTDAYS THEN GOTO FLAGDATE

MAY2:
   IF M2 <> 5 THEN GOTO JUN2
   MONTH$ = "May"
   TOTDAYS = 31
   ARROW = 14
   ARCOL = 67
   IF D2 < 1 OR D2 > TOTDAYS THEN GOTO FLAGDATE

JUN2:
   IF M2 <> 6 THEN GOTO JUL2
   MONTH$ = "June"
   TOTDAYS = 30
   ARROW = 14
   ARCOL = 67
   IF D2 < 1 OR D2 > TOTDAYS THEN GOTO FLAGDATE

JUL2:
   IF M2 <> 7 THEN GOTO AUG2
   MONTH$ = "July"
   TOTDAYS = 31
   ARROW = 14
   ARCOL = 67
   IF D2 < 1 OR D2 > TOTDAYS THEN GOTO FLAGDATE

AUG2:
   IF M2 <> 8 THEN GOTO SEP2
   MONTH$ = "August"
   TOTDAYS = 31
   ARROW = 14
   ARCOL = 67
   IF D2 < 1 OR D2 > TOTDAYS THEN GOTO FLAGDATE

SEP2:
   IF M2 <> 9 THEN GOTO OCT2
```

```
    MONTH$ = "September"
    TOTDAYS = 30
    ARROW = 14
    ARCOL = 67
    IF D2 < 1 OR D2 > TOTDAYS THEN GOTO FLAGDATE

OCT2:
    IF M2 <> 10 THEN GOTO NOV2
    MONTH$ = "October"
    TOTDAYS = 31
    ARROW = 14
    ARCOL = 67
    IF D2 < 1 OR D2 > TOTDAYS THEN GOTO FLAGDATE

NOV2:
    IF M2 <> 11 THEN GOTO DEC2
    MONTH$ = "November"
    TOTDAYS = 31
    ARROW = 14
    ARCOL = 67
    IF D2 < 1 OR D2 > TOTDAYS THEN GOTO FLAGDATE

DEC2:
    MONTH$ = "December"
    TOTDAYS = 31
    ARROW = 14
    ARCOL = 67
    IF D2 < 1 OR D2 > TOTDAYS THEN GOTO FLAGDATE
    GOTO ADDTABLE

FLAGDATE:
    LOCATE 18,3,0
    PRINT MONTH$;" has ";TOTDAYS;" Press <ENTER> to Continue";
    INPUT X$
    LOCATE 18,3,0
    PRINT " ";TAB(80);" ";
    GOTO INITSCREEN

ADDTABLE:
    IF M1=1 THEN ADD1=0
    IF M1=2 THEN ADD1=31
    IF M1=3 THEN ADD1=59
    IF M1=4 THEN ADD1=90
    IF M1=5 THEN ADD1=120
    IF M1=6 THEN ADD1=151
    IF M1=7 THEN ADD1=181
    IF M1=8 THEN ADD1=212
    IF M1=9 THEN ADD1=243
    IF M1=10 THEN ADD1=273
    IF M1=11 THEN ADD1=304
    IF M1=12 THEN ADD1=334
    IF M2=1 THEN ADD2=0
```

```
    IF M2=2 THEN ADD2=31
    IF M2=3 THEN ADD2=59
    IF M2=4 THEN ADD2=90
    IF M2=5 THEN ADD2=120
    IF M2=6 THEN ADD2=151
    IF M2=7 THEN ADD2=181
    IF M2=8 THEN ADD2=212
    IF M2=9 THEN ADD2=243
    IF M2=10 THEN ADD2=273
    IF M2=11 THEN ADD2=304
    IF M2=12 THEN ADD2=334
    JDFRST = ADD1 + D1
    JDLAST = ADD2 + D2
    YEARS = Y2 - Y1
    DAYS = JDLAST - JDFRST + (365 * YEARS)

CHECKLENGTH:
    LOCATE 18,3,0
    PRINT "Analysis Period is ";DAYS;" Days in Length. If";
    PRINT " This is Correct,"
    LOCATE 19,3,0
    PRINT "Press <ENTER> to Continue or, Type: 'C' to Change";
    INPUT " and Press <ENTER>";SEL$
    IF SEL$ = "" THEN GOTO UPDATEYEAR
    IF SEL$ <> "C" AND SEL$ <> "c" THEN GOTO CHECKLENGTH
    LOCATE 18,3,0
    PRINT" ";TAB(80);" ";
    LOCATE 19,3,0
    PRINT" ";TAB(80);" ";
    GOTO INITSCREEN

UPDATEYEAR:
    IF YEARS > 0 THEN JDLAST = 365

WEATHSCRN:
    CLS
    COLOR 14,1
    PRINT
    PRINT "          PLEASE SELECT A WEATHER DATA SET FROM THE";
    PRINT " FOLLOWING LIST"
    PRINT
    PRINT "                                EXISTING DATA SETS:"
    PRINT
    WEATH$(1) = "LAKE CONCORDIA - 1974"
    WEATH$(2) = "NEW ORLEANS - 1979"
    WEATH$(3) = "NEW ORLEANS - 1980"
    WEATH$(4) = "NEW ORLEANS - 1981"
    WEATH$(5) = "FLORIDA - 1975"
    WEATH$(6) = "FLORIDA - 1976"
    WEATH$(7) = "FLORIDA - 1977"
    WEATH$(8) = "FLORIDA - 1978"
    WEATH$(9) = "FLORIDA - 1979"
```

```
   FOR W = 1 TO 9
   PRINT"                                        ";WEATH$(W)
   NEXT W
   LOCATE 23,5,0
   PRINT "MOVE CURSOR TO SELECTED DATA SET AND PRESS <ENTER> TO CONTINUE"
   CURROW = 6

REPCUR:
   LOCATE CURROW,29,0
   COLOR 19
   PRINT CHR$(178)
   COLOR 14,1

CHOOSE5:
   SEL$ = INKEY$
   IF SEL$ = "" THEN GOTO CHOOSE5
   DEF SEG=0:POKE 1050,PEEK(1052)
   SEL$ = RIGHT$(SEL$,1)
   LOCATE CURROW,29,0
   PRINT CHR$(32)
   IF SEL$ = CHR$(72) THEN CURROW = CURROW - 1
   IF SEL$ = CHR$(80) THEN CURROW = CURROW + 1
   IF CURROW < 6 THEN CURROW = 6
   IF CURROW > 14 THEN CURROW = 14
   IF SEL$ = CHR$(13) THEN GOTO GOTSET
   GOTO REPCUR

GOTSET:
   NA = CURROW - 5

TELLSET:
   LOCATE 20,2,0
   PRINT "WEATHER DATA SET SELECTED IS: ";WEATH$(NA);".";
   PRINT " IF THIS IS CORRECT,"
   LOCATE 21,2,0
   PRINT "PRESS <ENTER> TO CONTINUE OR TYPE: 'C' AND PRESS";
   PRINT " <ENTER> TO MAKE A CHANGE."
   INPUT CH$
   IF CH$ = "" THEN GOTO CHAINWEATH
   IF CH$ <> "C" AND CH$ <> "c" THEN GOTO TELLSET
   LOCATE 20,4,0
   PRINT" ";TAB(80);" ";
   LOCATE 21,4,0
   PRINT" ";TAB(80);" ";
   GOTO WEATHSCRN

CHAINWEATH:
   IF NA = 1 THEN WDATA$ = "W74J.DAT"
   IF NA = 2 THEN WDATA$ = "W79.DAT"
   IF NA = 3 THEN WDATA$ = "W80.DAT"
   IF NA = 4 THEN WDATA$ = "W81.DAT"
   IF NA = 5 THEN WDATA$ = "W75F.DAT"
```

```
    IF NA = 6 THEN WDATA$ = "W76F.DAT"
    IF NA = 7 THEN WDATA$ = "W77F.DAT"
    IF NA = 8 THEN WDATA$ = "W78F.DAT"
    IF NA = 9 THEN WDATA$ = "W79F.DAT"
    CLS
    LOCATE 12,20,0
    PRINT "CALCULATIONS IN PROGRESS, PLEASE WAIT"
    RETURN

QUIT:
  CLOSE
  CHAIN PPATH$ + "MODI"

TRAP:
  SCREEN 2
  SCREEN 0,1,0,0
  COLOR 7,1
  CLS
  PRINT " ";TAB(30);"ERROR INFORMATION"
  COLOR 14,1
  PRINT "═══════════════════════════════════════";
  PRINT "═══════════════════════════════════════"
  DEF SEG=0:POKE 1050,PEEK(1052)
KNOWN:
  IF ERR < 24 THEN GOTO UNKNOWN
  IF ERR = 26 THEN GOTO UNKNOWN
  IF ERR > 27 AND ERR < 52 THEN GOTO UNKNOWN
  IF ERR > 53 AND ERR < 61 THEN GOTO UNKNOWN
  IF ERR > 61 AND ERR < 68 THEN GOTO UNKNOWN
  IF ERR = 69 THEN GOTO UNKNOWN
  IF ERR > 72 AND ERR < 76 THEN GOTO UNKNOWN
  IF ERR > 76 THEN GOTO UNKNOWN
  LOCATE 8,10,0
  PRINT "AN ERROR HAS OCCURRED DURING THE OPERATION OF THIS PROGRAM:"
  LOCATE 10,5,0
  IF ERR = 24 THEN PRINT "DISK DRIVE OR PRINTER IS NOT TURNED ON";
    IF ERR = 24 THEN PRINT "OR PLUGGED IN"
  IF ERR = 25 THEN PRINT "HARDWARE MALFUNCTION"
  IF ERR = 27 THEN PRINT "THE PRINTER IS OUT OF PAPER"
  IF ERR = 52 THEN PRINT "THE FILE NAME IS INVALID. RENAME THE FILE."
  IF ERR = 61 THEN PRINT "YOU WILL HAVE TO USE A NEW DISK. THIS ONE IS FULL"
  IF ERR = 68 THEN PRINT "TARGET DEVICE DOES NOT EXIST, THIS PROGRAM"
    IF ERR = 68 THEN PRINT "ATTEMPTED TO ACCESS A DISK DRIVE OR PRINTER"
    IF ERR = 68 THEN PRINT "WHICH IS NOT PRESENT. SOFTWARE MUST BE RE-"
    IF ERR = 68 THEN PRINT "CONFIGURED TO PERFORM THE REQUESTED ACTION"
  IF ERR = 70 THEN PRINT "THE DISK IS WRITE PROTECTED"
  IF ERR = 53 OR ERR = 76 THEN PRINT "PROBABLY THE WRONG DISK IS IN";
    IF ERR = 53 OR ERR = 76 THEN PRINT " THE DISK DRIVE."
  IF ERR = 71 THEN PRINT "EITHER THE DISK DRIVE DOOR IS OPEN OR THERE";
    IF ERR = 71 THEN PRINT " IS NO DISK IN THE DRIVE"
  IF ERR = 72 THEN PRINT "THE DISKETTE IS PROBABLY BAD. USE A NEW DISKETTE"
  GOTO PAUSE
```

```
UNKNOWN:
  LOCATE 10,5,0
  PRINT "AN ERROR HAS BEEN IDENTIFIED IN THIS PROGRAM. PLEASE CONTACT"
  LOCATE 11,5,0
  PRINT "YOUR SOFTWARE SUPPORT REPRESENTATIVE AND REPORT THAT ERROR"
  LOCATE 12,5,0
  PRINT "NUMBER";ERR;" OCCURRED IN SUB-ROUTINE: ";LINK$
  LOCATE 20,28,0
  COLOR 20
  PRINT "PRESS ANY KEY TO CONTINUE"
  COLOR 14,1
  GOTO SCAN
PAUSE:
  LOCATE 20,15,0
  COLOR 20
  PRINT "CORRECT THIS ERROR AND PRESS ANY KEY TO CONTINUE"
  COLOR 14,1
  CLOSE
SCAN:
  SEL$ = INKEY$
  IF SEL$ = "" THEN GOTO SCAN
  CLS
  RESUME BEGIN
```

Subroutine MODI

```
START:
   DIM A$(24,2)
   DIM A(24,1)
   DIM F$(60)
   DIM B(25)
   DIM MENU$(10)
   DIM RESULT$(10)
   DIM FILESIN$(60)
   COMMON DSKID$,A$(),A(),F$(),B(),TYPE$,DIRECT$,UNITS$
   COMMON PPMDAYS,INITBIOM,DIR$,SPECNAME$,PERDRY
   COMMON CHEMNAME$,PRNTPLACE$,LINK$,PPATH$,DPATH$
   COMMON MENU$(),MAXITEM,RESULT$(),TITLE$,COUNT,CURBIOM
   LINK$ = "MODI"
   CLS
   ON ERROR GOTO TRAP
   IF DSKID$ = "HD" THEN GOTO BEGIN

PRNTEXT:
   COLOR 14,1
   CLS
   LOCATE 12,5,0
   PRINT "Please Place Program Disk 1 (Module I - Fate)"
   LOCATE 14,5,0
   PRINT "in Drive ";PPATH$;" and Press any Key to Continue"

   CHKCHOOSE:
```

```
      SEL$=INKEY$
      IF SEL$="" THEN GOTO CHKCHOOSE

   OPEN PPATH$ + "DSKID.CHK" FOR INPUT AS #1
   INPUT #1,DSKID$
   CLOSE #1
   IF DSKID$ = "PROG1" THEN GOTO BEGIN ELSE GOTO PRNTEXT

BEGIN:
   TITLE$ = "                                Restart Program Menu"
   MENU$(1) = "1. Restart Program From Beginning"
   MENU$(2) = "2. Load New Data File or Load Defaults"
   MENU$(3) = "3. Change / Review Data"
   MENU$(4) = "4. Help and Instructions"
   MENU$(5) = "5. Exit HERBICIDE Program"
   MENU$(6) = "6. Issue a DOS Command"
   RESULT$(1) = "SELECT"
   RESULT$(2) = "INPUT"
   RESULT$(3) = "ENTER"
   RESULT$(4) = "HELP1"
   RESULT$(5) = "QUIT"
   RESULT$(6) = "DOSCOM"
   MAXITEM = 6
   CHAIN PPATH$ + "MENU"

TRAP:
  SCREEN 2
  SCREEN 0,1,0,0
  COLOR 7,1
  CLS
  PRINT " ";TAB(30);"ERROR INFORMATION"
  COLOR 14,1
  PRINT "═══════════════════════════════════════";
  PRINT "═══════════════════════════════════════"
  DEF SEG=0:POKE 1050,PEEK(1052)
KNOWN:
  IF ERR < 24 THEN GOTO UNKNOWN
  IF ERR = 26 THEN GOTO UNKNOWN
  IF ERR > 27 AND ERR < 52 THEN GOTO UNKNOWN
  IF ERR > 53 AND ERR < 61 THEN GOTO UNKNOWN
  IF ERR > 61 AND ERR < 68 THEN GOTO UNKNOWN
  IF ERR = 69 THEN GOTO UNKNOWN
  IF ERR > 72 AND ERR < 76 THEN GOTO UNKNOWN
  IF ERR > 76 THEN GOTO UNKNOWN
  LOCATE 8,10,0
  PRINT "AN ERROR HAS OCCURRED DURING THE OPERATION OF THIS PROGRAM:"
  LOCATE 10,5,0
  IF ERR = 24 THEN PRINT "DISK DRIVE OR PRINTER IS NOT TURNED ON";
    IF ERR = 24 THEN PRINT "OR PLUGGED IN"
  IF ERR = 25 THEN PRINT "HARDWARE MALFUNCTION"
  IF ERR = 27 THEN PRINT "THE PRINTER IS OUT OF PAPER"
  IF ERR = 52 THEN PRINT "THE FILE NAME IS INVALID. RENAME THE FILE."
```

```
  IF ERR = 61 THEN PRINT "YOU WILL HAVE TO USE A NEW DISK. THIS ONE IS FULL!"
  IF ERR = 68 THEN PRINT "TARGET DEVICE DOES NOT EXIST, THIS PROGRAM"
    IF ERR = 68 THEN PRINT "ATTEMPTED TO ACCESS A DISK DRIVE OR PRINTER"
    IF ERR = 68 THEN PRINT "WHICH IS NOT PRESENT. SOFTWARE MUST BE RE-"
    IF ERR = 68 THEN PRINT "CONFIGURED TO PERFORM THE REQUESTED ACTION"
  IF ERR = 70 THEN PRINT "THE DISK IS WRITE PROTECTED"
  IF ERR = 53 OR ERR = 76 THEN PRINT "PROBABLY THE WRONG DISK IS IN";
    IF ERR = 53 OR ERR = 76 THEN PRINT " THE DISK DRIVE."
  IF ERR = 71 THEN PRINT "EITHER THE DISK DRIVE DOOR IS OPEN OR THERE";
    IF ERR = 71 THEN PRINT " IS NO DISK IN THE DRIVE"
  IF ERR = 72 THEN PRINT "THE DISKETTE IS PROBABLY BAD. USE A NEW DISKETTE"
  GOTO PAUSE
UNKNOWN:
  LOCATE 10,5,0
  PRINT "AN ERROR HAS BEEN IDENTIFIED IN THIS PROGRAM. PLEASE CONTACT"
  LOCATE 11,5,0
  PRINT "YOUR SOFTWARE SUPPORT REPRESENTATIVE AND REPORT THAT ERROR"
  LOCATE 12,5,0
  PRINT "NUMBER";ERR;" OCCURRED IN SUB-ROUTINE: ";LINK$
  LOCATE 20,28,0
  COLOR 20
  PRINT "PRESS ANY KEY TO CONTINUE"
  COLOR 14,1
  GOTO SCAN
PAUSE:
  LOCATE 20,15,0
  COLOR 20
  PRINT "CORRECT THIS ERROR AND PRESS ANY KEY TO CONTINUE"
  COLOR 14,1
  CLOSE
SCAN:
  SEL$ = INKEY$
  IF SEL$ = "" THEN GOTO SCAN
  CLS
  RESUME START
```

APPENDIX C

Raw Data Sets

Microcosm Study.

Day = 0 Target	Plant Density Metric Tons / ha	2,4-D in water (mg/l)	2,4-D in plants (mg/kg wet weight)	2,4-D in sediments (mg/kg wet weight)
4.90 liters / ha	108	1.300	17.028	0.036
4.90 liters / ha	28	1.407	8.936	0.000
4.90 liters / ha	56	1.573	8.362	0.000
2.45 liters / ha	108	0.287	4.964	0.000
2.45 liters / ha	28	0.260	1.514	0.051
2.45 liters / ha	56	0.667	1.643	0.043
0.49 liters / ha	108	0.207	2.076	0.016
0.49 liters / ha	28	0.067	0.662	0.000
0.49 liters / ha	56	0.093	1.433	0.000
0.10 liters / ha	108	0.053	0.235	0.000
0.10 liters / ha	28	0.060	0.317	0.000
0.10 liters / ha	56	0.053	0.774	0.000
0.25 ppm aqueous	108	0.080	0.055	0.238
0.05 ppm aqueous	28	0.053	0.000	0.043
0.10 ppm aqueous	56	0.060	0.032	0.000
100 sec. contact @ 2 PPM	56	0.000	0.000	0.000
10 sec. contact @ 2 PPM	56	0.000	0.000	0.075
1 sec. contact @ 2 PPM	56	0.000	0.000	0.000
control	56	0.000	0.000	0.000
control	56	0.000	0.000	0.000
control	56	0.000	0.000	0.000

Microcosm Study.

Day = 1 Target	Plant Density Metric Tons / ha	2,4-D in water (mg/l)	2,4-D in plants (mg/kg wet weight)	2,4-D in sediments (mg/kg wet weight)
4.90 liters / ha	108	0.100	24.236	0.111
4.90 liters / ha	28	0.153	16.482	0.000
4.90 liters / ha	56	0.133	9.433	0.000
2.45 liters / ha	108	0.087	5.538	0.000
2.45 liters / ha	28	0.113	1.777	0.000
2.45 liters / ha	56	0.093	3.046	0.000
0.49 liters / ha	108	0.053	1.630	0.000
0.49 liters / ha	28	0.087	0.761	0.000
0.49 liters / ha	56	0.067	0.684	0.000
0.10 liters / ha	108	0.067	1.070	0.000
0.10 liters / ha	28	0.060	0.455	0.000
0.10 liters / ha	56	0.067	0.630	0.000
0.25 ppm aqueous	108	0.053	0.000	0.000
0.05 ppm aqueous	28	0.080	0.082	0.000
0.10 ppm aqueous	56	0.060	0.055	0.000
100 sec. contact @ 2 PPM	56	0.000	0.065	0.000
10 sec. contact @ 2 PPM	56	0.000	0.096	0.000
1 sec. contact @ 2 PPM	56	0.000	0.069	0.000
control	56	0.000	0.000	0.000
control	56	0.000	0.000	0.000
control	56	0.000	0.000	0.000

Microcosm Study.

Day = 4 Target	Plant Density Metric Tons / ha	2,4-D in water (mg/l)	2,4-D in plants (mg/kg wet weight)	2,4-D in sediments (mg/kg wet weight)
4.90 liters / ha	108	0.220	3.983	0.000
4.90 liters / ha	28	0.160	1.452	0.000
4.90 liters / ha	56	0.160	2.232	0.000
2.45 liters / ha	108	0.020	1.638	0.000
2.45 liters / ha	28	0.047	1.566	0.000
2.45 liters / ha	56	0.020	4.957	0.000
0.49 liters / ha	108	0.000	2.262	0.000
0.49 liters / ha	28	0.000	1.140	0.000
0.49 liters / ha	56	0.000	0.616	0.000
0.10 liters / ha	108	0.000	0.528	0.000
0.10 liters / ha	28	0.000	0.273	0.000
0.10 liters / ha	56	0.000	0.382	0.000
0.25 ppm aqueous	108	0.020	0.092	0.000
0.05 ppm aqueous	28	0.000	0.000	0.000
0.10 ppm aqueous	56	0.000	0.075	0.000
100 sec. contact @ 2 PPM	56	0.000	0.115	0.000
10 sec. contact @ 2 PPM	56	0.000	0.065	0.000
1 sec. contact @ 2 PPM	56	0.000	0.097	0.000
control	56	0.000	0.000	0.000
control	56	0.000	0.000	0.000
control	56	0.000	0.000	0.000

Microcosm Study.

Day = 7 Target	Plant Density Metric Tons / ha	2,4-D in water (mg/l)	2,4-D in plants (mg/kg wet weight)	2,4-D in sediments (mg/kg wet weight)
4.90 liters / ha	108	0.107	3.729	0.000
4.90 liters / ha	28	0.173	3.831	0.000
4.90 liters / ha	56	0.173	1.625	0.000
2.45 liters / ha	108	0.080	1.450	0.000
2.45 liters / ha	28	0.120	0.604	0.000
2.45 liters / ha	56	0.100	0.437	0.000
0.49 liters / ha	108	0.060	0.537	0.000
0.49 liters / ha	28	0.067	0.832	0.000
0.49 liters / ha	56	0.060	0.866	0.000
0.10 liters / ha	108	0.000	0.289	0.000
0.10 liters / ha	28	0.060	0.314	0.000
0.10 liters / ha	56	0.053	0.070	0.000
0.25 ppm aqueous	108	0.093	0.071	0.000
0.05 ppm aqueous	28	0.060	0.077	0.000
0.10 ppm aqueous	56	0.073	0.304	0.000
100 sec. contact @ 2 PPM	56	0.053	0.127	0.000
10 sec. contact @ 2 PPM	56	0.000	0.096	0.000
1 sec. contact @ 2 PPM	56	0.053	0.193	0.000
control	56	0.000	0.000	0.000
control	56	0.000	0.000	0.000
control	56	0.000	0.000	0.000

Microcosm Study.

Day = 14 Target	Plant Density Metric Tons / ha	2,4-D in water (mg/l)	2,4-D in plants (mg/kg wet weight)	2,4-D in sediments (mg/kg wet weight)
4.90 liters / ha	108	0.113	0.337	0.000
4.90 liters / ha	28	0.000	0.248	0.000
4.90 liters / ha	56	0.060	0.066	0.000
2.45 liters / ha	108	0.073	0.076	0.000
2.45 liters / ha	28	0.080	0.123	0.000
2.45 liters / ha	56	0.060	0.970	0.000
0.49 liters / ha	108	0.053	0.396	0.000
0.49 liters / ha	28	0.000	0.097	0.000
0.49 liters / ha	56	0.000	0.172	0.000
0.10 liters / ha	108	0.000	0.025	0.000
0.10 liters / ha	28	0.000	0.075	0.000
0.10 liters / ha	56	0.000	0.039	0.000
0.25 ppm aqueous	108	0.147	0.043	0.000
0.05 ppm aqueous	28	0.053	0.024	0.000
0.10 ppm aqueous	56	0.087	0.032	0.000
100 sec. contact @ 2 PPM	56	0.000	0.000	0.000
10 sec. contact @ 2 PPM	56	0.000	0.000	0.000
1 sec. contact @ 2 PPM	56	0.000	0.000	0.000
control	56	0.000	0.000	0.000
control	56	0.000	0.000	0.000
control	56	0.000	0.000	0.000

Microcosm Study.

Day = 21 Target	Plant Density Metric Tons / ha	2,4-D in water (mg/l)	2,4-D in plants (mg/kg wet weight)	2,4-D in sediments (mg/kg wet weight)
4.90 liters / ha	108	0.000	0.099	0.000
4.90 liters / ha	28	0.000	0.022	0.000
4.90 liters / ha	56	0.000	0.023	0.000
2.45 liters / ha	108	0.000	0.312	0.000
2.45 liters / ha	28	0.000	0.108	0.000
2.45 liters / ha	56	0.000	0.179	0.000
0.49 liters / ha	108	0.000	0.092	0.000
0.49 liters / ha	28	0.000	0.043	0.000
0.49 liters / ha	56	0.000	0.049	0.000
0.10 liters / ha	108	0.000	0.036	0.000
0.10 liters / ha	28	0.000	0.043	0.000
0.10 liters / ha	56	0.000	0.056	0.000
0.25 ppm aqueous	108	0.000	0.000	0.000
0.05 ppm aqueous	28	0.000	0.000	0.000
0.10 ppm aqueous	56	0.000	0.000	0.000
100 sec. contact @ 2 PPM	56	0.000	0.000	0.000
10 sec. contact @ 2 PPM	56	0.000	0.000	0.000
1 sec. contact @ 2 PPM	56	0.000	0.000	0.000
control	56	0.000	0.000	0.000
control	56	0.000	0.000	0.000
control	56	0.000	0.000	0.000

Microcosm Study.

day = 0

Target	Mean Individual Plant Biomass (grams)	Standard Deviation
4.90 liters / ha	358.89	94.93
2.45 liters / ha	437.78	133.58
0.49 liters / ha	413.33	126.89
0.10 liters / ha	442.22	82.12
0.05 ppm aqueous	336.67	111.50
0.10 ppm aqueous	280.00	140.00
0.25 ppm aqueous	373.33	236.92
1 sec contact @ 2 ppm	366.67	128.58
10 sec contact @ 2 ppm	296.67	55.08
100 sec contact @ 2 ppm	383.33	35.12
control	335.56	94.22

day = 7

target	Mean Individual Plant Biomass (grams)	Standard Deviation
4.90 liters / ha	354.44	99.51
2.45 liters / ha	418.89	148.87
0.49 liters / ha	382.22	156.59
0.10 liters / ha	422.22	159.90
0.05 ppm aqueous	396.67	47.26
0.10 ppm aqueous	416.67	240.90
0.25 ppm aqueous	410.00	79.37
1 sec contact @ 2 ppm	440.00	50.00
10 sec contact @ 2 ppm	436.67	240.90
100 sec contact @ 2 ppm	403.33	96.09
control	395.56	101.13

Microcosm Study.

day = 14

Target	Mean Individual Plant Biomass (grams)	Standard Deviation
4.90 liters / ha	355.56	106.78
2.45 liters / ha	330.00	94.60
0.49 liters / ha	361.11	97.27
0.10 liters / ha	518.89	116.77
0.05 ppm aqueous	396.67	55.08
0.10 ppm aqueous	386.67	201.33
0.25 ppm aqueous	460.00	80.00
1 sec contact @ 2 ppm	396.67	40.41
10 sec contact @ 2 ppm	376.67	172.14
100 sec contact @ 2 ppm	366.67	110.15
control	408.89	70.97

day = 21

target	Mean Individual Plant Biomass (grams)	Standard Deviation
4.90 liters / ha	307.78	85.11
2.45 liters / ha	404.44	105.49
0.49 liters / ha	322.22	109.86
0.10 liters / ha	570.00	173.78
0.05 ppm aqueous	226.67	23.09
0.10 ppm aqueous	486.67	185.83
0.25 ppm aqueous	373.33	100.66
1 sec contact @ 2 ppm	433.33	49.33
10 sec contact @ 2 ppm	426.67	183.39
100 sec contact @ 2 ppm	366.67	140.12
control	481.11	87.67

Field Validation Study.

Sample Type = Leaves day = -1

Sample ID #	Replicate	2,4-D (mg/kg) in Plant Tissue	Total Weight per sq. Meter (kg)	Rinse Sample ID #	2,4-D in Rinse (mg/kg plant)
00010012	1	0.000	23.60	00010010	0.000
00010016	2	0.000	23.60	00010014	0.000
00010019	3	0.000	18.80	00010021	0.000
00010028	4	0.000	18.40	00010022	0.000
00010031	5	0.000	18.60	00010023	0.000
00010034	6	0.000	20.00	00010024	0.000
00010038	7	0.000	18.28	00010025	0.000
00010041	8	0.000	20.32	00010026	0.000
00010044	9	0.000	19.80	00010027	0.000

Sample Type = Leaves day = 1

Sample ID #	Replicate	2,4-D (mg/kg) in Plant Tissue	Total Weight per sq. Meter (kg)	Rinse Sample ID #	2,4-D in Rinse (mg/kg plant)
00010056	1	11.54	21.20	00010083	0.278
00010059	2	4.997	19.80	00010084	0.275
00010062	3	4.871	21.20	00010085	0.209
00010065	4	4.144	19.28	00010086	0.112
00010068	5	6.685	20.60	00010087	0.087
00010071	6	4.291	24.12	00010088	0.118
00010074	7	11.11	19.24	00010089	0.131
00010077	8	8.458	20.44	00010090	0.138
00010080	9	8.444	17.64	00010091	0.157

Field Validation Study.

Sample Type = Leaves day = 2

Sample ID #	Replicate	2,4-D (mg/kg) in Plant Tissue	Total Weight per sq. Meter (kg)	Rinse Sample ID #	2,4-D in Rinse (mg/kg plant)
00010101	1	9.057	19.26	00010137	0.220
00010104	2	6.245	17.08	00010138	0.082
00010107	3	3.889	21.60	00010139	0.094
00010110	4	4.222	16.80	00010140	.
00010113	5	5.139	19.12	00010141	0.129
00010116	6	2.214	18.24	00010142	0.078
00010119	7	8.971	23.20	00010143	0.271
00010122	8	10.95	18.56	00010144	0.042
00010125	9	7.029	23.20	00010145	0.018

Sample Type = Leaves day = 4

Sample ID #	Replicate	2,4-D (mg/kg) in Plant Tissue	Total Weight per sq. Meter (kg)	Rinse Sample ID #	2,4-D in Rinse (mg/kg plant)
00010146	1	2.443	23.8	00010182	0.050
00010149	2	0.050	24.6	00010183	0.109
00010152	3	0.000	23.2	00010184	0.111
00010155	4	8.401	30.8	00010185	0.119
00010158	5	1.535	26.0	00010186	0.028
00010161	6	1.411	24.2	00010187	0.040
00010164	7	6.635	18.4	00010188	0.060
00010167	8	1.397	23.0	00010189	0.028
00010170	9	4.879	16.8	00010190	0.053

Field Validation Study.

Sample Type = Leaves day = 7

Sample ID #	Replicate	2,4-D (mg/kg) in Plant Tissue	Total Weight per sq. Meter (kg)	Rinse Sample ID #	2,4-D in Rinse (mg/kg plant)
00010191	1	8.649	21.6	00010227	0.059
00010194	2	2.224	18.2	00010228	0.067
00010197	3	4.546	20.2	00010229	0.157
00010200	4	7.963	22.4	00010230	0.158
00010203	5	1.485	21.8	00010231	0.036
00010206	6	9.937	20.2	00010232	0.148
00010209	7	2.043	19.6	00010233	0.015
00010212	8	7.207	23.0	00010234	0.046
00010215	9	5.439	22.4	00010235	0.070

Sample Type = Leaves day = 14

Sample ID #	Replicate	2,4-D (mg/kg) in Plant Tissue	Total Weight per sq. Meter (kg)	Rinse Sample ID #	2,4-D in Rinse (mg/kg plant)
00010236	1	2.578	19.6	00010272	0.008
00010239	2	8.058	17.2	00010273	0.011
00010242	3	0.730	19.2	00010274	0.004
00010245	4	3.232	17.0	00010275	0.005
00010248	5	4.430	14.2	00010276	0.008
00010251	6	0.644	20.8	00010277	0.007
00010254	7	2.815	19.2	00010278	0.045
00010257	8	2.503	16.6	00010279	0.014
00010260	9	1.246	19.2	00010280	0.028

Field Validation Study.

Sample Type = Leaves day = 28

Sample ID #	Replicate	2,4-D (mg/kg) in Plant Tissue	Total Weight per sq. Meter (kg)	Rinse Sample ID #	2,4-D in Rinse (mg/kg plant)
00010288	1	0.390	20.4	00010316	0.000
00010291	2	0.226	13.6	00010317	0.000
00010294	3	0.061	16.0	00010318	0.000
00010297	4	0.416	14.2	00010319	0.000
00010300	5	0.762	11.8	00010320	0.000
00010303	6	0.080	16.0	00010321	0.000
00010306	7	0.388	15.0	00010322	0.000
00010309	8	0.188	14.4	00010323	0.000
00010312	9	0.099	17.2	00010324	0.000

Sample Type = Roots day = -1

Sample ID #	Replicate	2,4-D (mg/kg) in Plant Tissue	Total Weight per sq. Meter (kg)
00010013	1	0.000	5.60
00010017	2	0.000	5.80
00010020	3	0.000	4.60
00010030	4	0.000	5.04
00010033	5	0.000	5.40
00010036	6	0.000	4.84
00010039	7	0.000	4.72
00010042	8	0.000	4.68
00010045	9	0.000	4.92

Field Validation Study.

Sample ID #	Replicate	2,4-D (mg/kg) in Plant Tissue	Total Weight per sq. Meter (kg)
Sample Type = Roots day = 1			
00010057	1	1.172	3.48
00010060	2	0.175	4.84
00010063	3	0.211	5.08
00010066	4	0.259	3.60
00010069	5	0.208	3.44
00010072	6	0.143	4.32
00010075	7	0.635	5.24
00010078	8	0.420	4.64
00010081	9	0.452	4.00
Sample Type = Roots day = 2			
Sample ID #	Replicate	2,4-D (mg/kg) in Plant Tissue	Total Weight per sq. Meter (kg)
00010102	1	0.630	3.84
00010105	2	0.430	3.08
00010108	3	0.086	4.00
00010111	4	0.313	3.48
00010114	5	0.126	3.24
00010117	6	0.099	4.36
00010120	7	0.281	4.84
00010123	8	0.228	3.44
00010126	9	0.268	3.92

Field Validation Study.

Sample ID #	Replicate	2,4-D (mg/kg) in Plant Tissue	Total Weight per sq. Meter (kg)
Sample Type = Roots day = 4			
00010147	1	0.165	3.8
00010150	2	0.050	3.6
00010153	3	0.074	4.0
00010156	4	0.377	5.4
00010159	5	0.139	5.2
00010162	6	0.082	4.8
00010165	7	0.349	3.6
00010168	8	0.069	5.4
00010171	9	0.271	4.2
Sample Type = Roots day = 7			
Sample ID #	**Replicate**	**2,4-D (mg/kg) in Plant Tissue**	**Total Weight per sq. Meter (kg)**
00010192	1	0.326	4.4
00010195	2	0.148	3.6
00010198	3	0.235	4.0
00010201	4	0.440	4.4
00010204	5	0.215	3.8
00010207	6	0.592	4.4
00010210	7	0.219	2.8
00010213	8	0.467	3.2
00010216	9	0.300	4.4

Field Validation Study.

Sample Type = Roots day = 14			
Sample ID #	Replicate	2,4-D (mg/kg) in Plant Tissue	Total Weight per sq. Meter (kg)
00010237	1	0.184	3.2
00010240	2	0.516	2.2
00010243	3	0.111	2.2
00010246	4	0.166	2.6
00010249	5	0.212	2.2
00010252	6	0.135	3.4
00010255	7	0.334	3.2
00010258	8	0.298	2.8
00010261	9	0.150	3.4
Sample Type = Roots day = 28			
Sample ID #	Replicate	2,4-D (mg/kg) in Plant Tissue	Total Weight per sq. Meter (kg)
00010289	1	0.082	4.2
00010292	2	0.043	3.0
00010295	3	0.092	3.4
00010298	4	0.062	3.2
00010301	5	2.804	3.0
00010304	6	0.056	3.2
00010307	7	0.105	2.8
00010310	8	0.044	2.6
00010313	9	0.062	3.4

Field Validation Study.

Sample Type = Stems day = -1

Sample ID #	Replicate	2,4-D (mg/kg) in Plant Tissue	Total Weight per sq. Meter (kg)
00010011	1	0.000	3.24
00010015	2	0.000	3.32
00010018	3	0.000	2.80
00010029	4	0.000	2.96
00010032	5	0.000	2.80
00010035	6	0.000	2.80
00010037	7	0.000	2.68
00010040	8	0.000	3.00
00010043	9	0.000	2.76

Sample Type = Stems day = 1

Sample ID #	Replicate	2,4-D (mg/kg) in Plant Tissue	Total Weight per sq. Meter (kg)
00010058	1	0.936	3.24
00010061	2	0.157	3.20
00010064	3	0.140	3.48
00010067	4	0.264	3.20
00010070	5	0.157	3.00
00010073	6	0.137	3.52
00010076	7	0.481	2.60
00010079	8	0.289	3.24
00010082	9	0.173	2.60

Field Validation Study.

Sample Type = Stems day = 2

Sample ID #	Replicate	2,4-D (mg/kg) in Plant Tissue	Total Weight per sq. Meter (kg)
00010103	1	0.375	3.00
00010106	2	0.100	2.80
00010109	3	0.092	3.64
00010112	4	0.170	2.72
00010115	5	0.491	2.84
00010118	6	0.095	2.40
00010121	7	0.415	3.80
00010124	8	0.176	3.24
00010127	9	0.264	3.84

Sample Type = Stems day = 4

Sample ID #	Replicate	2,4-D (mg/kg) in Plant Tissue	Total Weight per sq. Meter (kg)
00010148	1	0.410	5.2
00010151	2	0.832	4.6
00010154	3	0.081	4.4
00010157	4	0.370	5.6
00010160	5	0.113	5.0
00010163	6	0.464	4.4
00010166	7	0.272	3.4
00010169	8	0.248	3.8
00010172	9	0.294	3.2

Field Validation Study.

Sample Type = Stems day = 7

Sample ID #	Replicate	2,4-D (mg/kg) in Plant Tissue	Total Weight per sq. Meter (kg)
00010193	1	0.711	3.8
00010196	2	0.414	3.4
00010199	3	0.548	3.8
00010202	4	0.440	3.8
00010205	5	0.576	4.0
00010208	6	0.552	3.8
00010211	7	0.577	3.8
00010214	8	1.436	4.2
00010217	9	0.464	4.2

Sample Type = Stems day = 14

Sample ID #	Replicate	2,4-D (mg/kg) in Plant Tissue	Total Weight per sq. Meter (kg)
00010238	1	0.385	3.8
00010241	2	0.590	2.8
00010244	3	0.099	3.4
00010247	4	0.154	3.6
00010250	5	0.513	2.6
00010253	6	0.124	3.4
00010256	7	0.409	3.2
00010259	8	0.521	3.0
00010262	9	0.130	2.6

Field Validation Study.

Sample Type = Stems day = 28			
Sample ID #	Replicate	2,4-D (mg/kg) in Plant Tissue	Total Weight per sq. Meter (kg)
00010290	1	0.043	3.8
00010293	2	0.244	3.2
00010296	3	0.044	2.8
00010299	4	0.019	3.0
00010302	5	0.018	3.0
00010305	6	0.019	3.8
00010308	7	0.063	3.2
00010311	8	0.043	2.8
00010314	9	0.031	4.0

Field Validation Study.

Sample Type = water day = -1

Sample ID #	Replicate	2,4-D conc. in water (mg/l)
00010001	1	0.000
00010002	2	0.000
00010003	3	0.000
00010004	4	0.000
00010005	5	0.000
00010006	6	0.000
00010007	7	0.000
00010008	8	0.000
00010009	9	0.000

Sample Type = water day = 1

Sample ID #	Replicate	2,4-D conc. in water (mg/l)
00010092	1	0.107
00010093	2	0.062
00010094	3	0.045
00010095	4	0.045
00010096	5	0.045
00010097	6	0.036
00010098	7	0.045
00010099	8	0.036
00010100	9	0.036

Sample Type = water day = 2

Sample ID #	Replicate	2,4-D conc. in water (mg/l)
00010128	1	0.018
00010129	2	0.018
00010130	3	0.027
00010131	4	0.009
00010132	5	0.027
00010133	6	0.009
00010134	7	0.018
00010135	8	0.018
00010136	9	0.009

Sample Type = water day = 4

Sample ID #	Replicate	2,4-D conc. in water (mg/l)
00010173	1	0.009
00010174	2	0.018
00010175	3	0.009
00010176	4	0.018
00010177	5	0.009
00010178	6	0.009
00010179	7	0.018
00010180	8	0.018
00010181	9	0.009

Field Validation Study.

Sample Type = water day = 7

Sample ID #	Replicate	2,4-D conc. in water (mg/l)
00010218	1	0.045
00010219	2	0.027
00010220	3	0.018
00010221	4	0.027
00010222	5	0.018
00010223	6	0.045
00010225	7	.
00010224	8	0.036
00010226	9	0.071

Sample Type = water day = 14

Sample ID #	Replicate	2,4-D conc. in water (mg/l)
00010263	1	0.027
00010264	2	0.018
00010265	3	0.027
00010266	4	0.018
00010267	5	0.018
00010285	6	0.000
00010269	7	0.018
00010286	8	0.000
00010271	9	0.018

Sample Type = water day = 28

Sample ID #	Replicate	2,4-D conc. in water (mg/l)
00010325	1	0.000
00010326	2	0.000
00010327	3	0.000
00010328	4	0.000
00010329	5	0.000
00010330	6	0.000
00010331	7	0.000
00010332	8	0.000
00010333	9	0.000

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