Bulletin 16:

COMPUTER SYSTEM FOR THE REDUCTION AND ANALYSIS OF SOIL MOISTURE DATA

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PREFACE

Quantitative evaluation of soil moisture for extended periods of time is a basic requirement in many areas of research of agricultural engineering and the life sciences. Soil-water-plant relationships almost always require detailed soil moisture measurements. This can involve the handling, processing, and analysis of thousands of individual measurements.

This report presents a program written in Forton IV to facilitate the reduction and analysis of soil moisture data. The system was prepared in three sections to allow complete flexibility in handling, processing, and analyzing moisture data.

The system provides for the processing of basic field data; the computing and accumulating of the total and/or available soil moisture for selected depth intervals; and the plotting and coding of the above data for subsequent evaluation by analysis of variance techniques.

The program allows for a detailed and comprehensive study of a wide range of statistically designed experiments to evaluate the availability and quantity of soil moisture. Probably the greatest utility of the system is its ability to provide a complete review of the moisture status at all levels in the soil profile and then to quickly ascertain all possible treatment combinations and interactions within the experimental design.

William R. Walker
Director

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INTRODUCTION

The quantitative evaluation of soil moisture through extended periods is a basic requirement in areas of research related to engineering, agriculture, and the life sciences. Invariably, it involves the processing and analysis of thousands of measurements. These are most often taken with nuclear soil moisture monitoring equipment.

It is the purpose of this report to present a system of computer programs, written in Fortran IV for the IBM 7040/1401 system, but readily convertible to other systems, designed specifically to expedite the reduction and analysis of soil moisture data. The system contains 3 unique and independent programs or sections. The first section consists of a reduction of the basic field data, the second section is a coding, summary and plotting routine, and the third section is an analysis of variance routine. These separations allow for a more general approach in the reduction procedure. Data are collected in the field, key punched from the field sheets, and processed in exactly the same order as they are obtained.

All data are properly identified so that no partiuclar input or processing order is necessary. The only requirement is that groups of data must be kept independent of each other. Following this procedure, all data and field notes can be processed (see Appendix A1) regardless of whether or not they are complete. Incomplete records will result when weather conditions or instrument malfunction prohibit the collection of moisture data over the entire experimental design. The second section of the system was designed so that all or only isolated segments of the output from Section 1 could be selected as the basic input data.

In most analysis of variance procedures, the order of input of the data is very important. Consequently, the soil moisture values to be used for such analyses must be placed in the required order. A function of Section 2 is to code the basic input data from Section 1 in such a way that it can be rapidly placed in the correct order by a minimum of passes through a sorter. For example, if the breakdown for analysis of variance includes blocks, dates, depths, and treatments, each moisture reading must be coded and placed on punch cards so that each of these items can be placed in its relative position for analysis by the sorter (see Appendix A4).

The basic features of the system may be summarized as follows:

a. Basic field data are processed and stored on magnetic tape as percentage moisture by volume (see Appendix A1).

b. Accumulated total or available soil moisture values can be determined by 3" increments to a depth of 30" and then by 6" increments to a maximum depth of 72".

c. Total or available soil moisture values can be determined at 6" increments to a maximum depth of 72".

d. Individual or groups of treatments can be summed over the entire experiment to determine the average total or available soil moisture for the increments given in item b above.

e. The data can be coded and placed on punch cards for subsequent analysis of variance or any other statistical analysis that may be desired.

f. The soil moisture values at any level can be plotted for any block-treatment combination evolving from items b, c, or d. Instructions for plotting these curves must be given in the order of b, c, or d. They cannot be intermixed.

g. An analysis of variance for a completely cross-classified design can run using as input the data obtained through item e.

As noted above computations can be performed with either total or available soil moisture. Available soil moisture is generally assumed to be water available for plant use and is considered by many researchers to be the water content between 1/3 and 15 atmospheres of tension. Total moisture is considered to be the total water held in the soil profile as determined by readings from nuclear moisture monitoring equipment.

The remainder of this report will be concerned with the function of Section 2 of the system. The presentation refers only to total soil moisture, however, the discussions are equally applicable to available soil moisture. Limited information is given in Appendixes A1, A2, A3, and A4 along with reference details as to where and how documentation of these sections can be obtained.

SOIL MOISTURE REDUCTION

As previously mentioned, Section 2 of the soil moisture reduction system is primarily a coding, summary, and plotting routine. In the items listed above under program features, b, c, d, e, and f may be attributed

to Section 2. The performance of all items is optional, i.e. by proper coding of parameter cards various functions can be either performed or omitted.

A listing of the source program for Section 2 is given in Appendix B1 and a detailed discussion of the program variables is given in Appendix B2. Most input/output variables have been omitted since they are discussed at their appropriate locations in the report.

INPUT

The input for Section 2 consists of (a) header card, (b) moisture tension tables, (c) identification tables, (d) parameter cards, and (e) soil moisture data. Items a, b, c, and d are on punch cards (these data are actually transferred to a system utility tape, SSUO5, by an IBM 1401 processor preparatory to being processed by the IBM 7040 computer) and item e is on magnetic tape. Item e is a direct output from Section 1.

Header Card

The function of the header card is to specify the type of analysis to be performed. Computations are based on available soil moisture when TYPE = 1 and total soil moisture when TYPE = 2.

The form of this card follows:

1	(card column)
X	(data format)
TYPE	(variable name)

Soil Moisture Tension Table

The soil moisture tension table contains the maximum available moisture and the lower limit of the available range for each block-treatment-depth combination in a given experiment. The available moisture is determined using this table and the percentage soil moisture values from Section 1. Note that this table is not required when total soil moisture is being determined, i.e. when TYPE = 2.

A common practice is to consider the available soil moisture as the soil moisture content between 1/3 and 15 atmospheres tension. With this criteria, the soil moisture tension table would contain percentage moisture

by volume, as determined from the laboratory, for the 15 atmosphere point (lower limit) and the 1/3 atmosphere point (upper limit).

The data card form for this table is given below followed by a description of variables. The data in columns 7-11 and 12-16 must be right justified when decimal points are not punched.

1-2	3-4	5-6	7-11	12-16	17-18
XX	XX	XX	XX.XX	XX.XX	XX
N3	N2	N1	B	AIJL(N3,N2,N1)	NSTP

Symbol	Description of Variables
AIJL	Lower limit of available soil moisture range. This limit is usually considered to be the moisture content at 15 atmospheres tension.
B	Upper limit of available soil moisture range. This limit is commonly considered to be the moisture content at 1/3 atmosphere tension.
N1	Integer code assigned to each depth at which soil moisture readings were obtained. This code must start with 1 and increase sequentially. A maximum of 12 values can be used.
N2	Integer code assigned to each treatment within the experiment. This code must start with 1 and increase sequentially. A maximum of 12 treatments can be used.
N3	Integer code assigned to the blocks within the experiment. The code must start with 1 and increase sequentially. A maximum of 12 blocks can be used.
NSTP	Index code indicating that the last card in the soil moisture tension table has been loaded.

Identification Tables

The system was designed so that meaningful alphabetic or numeric identification can be assigned to blocks, treatments, or access tubes. For statistical analyses where order is important, the data must be coded so

that they can be rapidly placed in any desired sequence. The identification tables contain the identifications that were arbitrarily assigned at the initiation of the experiment to each block, treatment, and moisture access tube. They also contain an integer code for each respective block, treatment, and tube (e.g. if there are 2 treatments, treatment 1 would be designated as 1 and treatment 2 as 2). The integer codes are arbitrarily assigned and must begin with 1 and increase sequentially.

For this system, 3 tables are required to obtain proper coding.

a. Block-treatment table
b. Access tube identification table
c. Depth identification table

Block-Treatment Table -- In most experimental plot designs that are replicated or blocked, the block-treatment identification is combined into one symbol, e.g. the treatment could be represented as NTM (no-tillage moisture), the block or replication as 1, all combined as NTM1. A typical experimental layout is shown in Figure 1. The integer codes associated with each block-treatment identification are shown in the format and variable description given below.

1-6	7-8	9-10	80
XXXXXX	XX	XX	X
TPFORM	BKCODE	TRCODE	KODE9

Symbol	Description of Variables
BKCODE (I) I = 1, 50	Block or replicate code (this code must be integer and the coding must progress in sequential order beginning with 1).
KODE9	A 9-punch in column 80 that identifies the last card of the block-treatment table.
TPFORM (I) I = 1, 50	Block-treatment identification. This code may contain either alphabetic or numeric information (e.g. NTM4 for no-tillage moisture-block 4).
TRCODE (I) I = 1, 50	Treatment code. (This code must be integer and the coding must progress in sequential order beginning with 1).

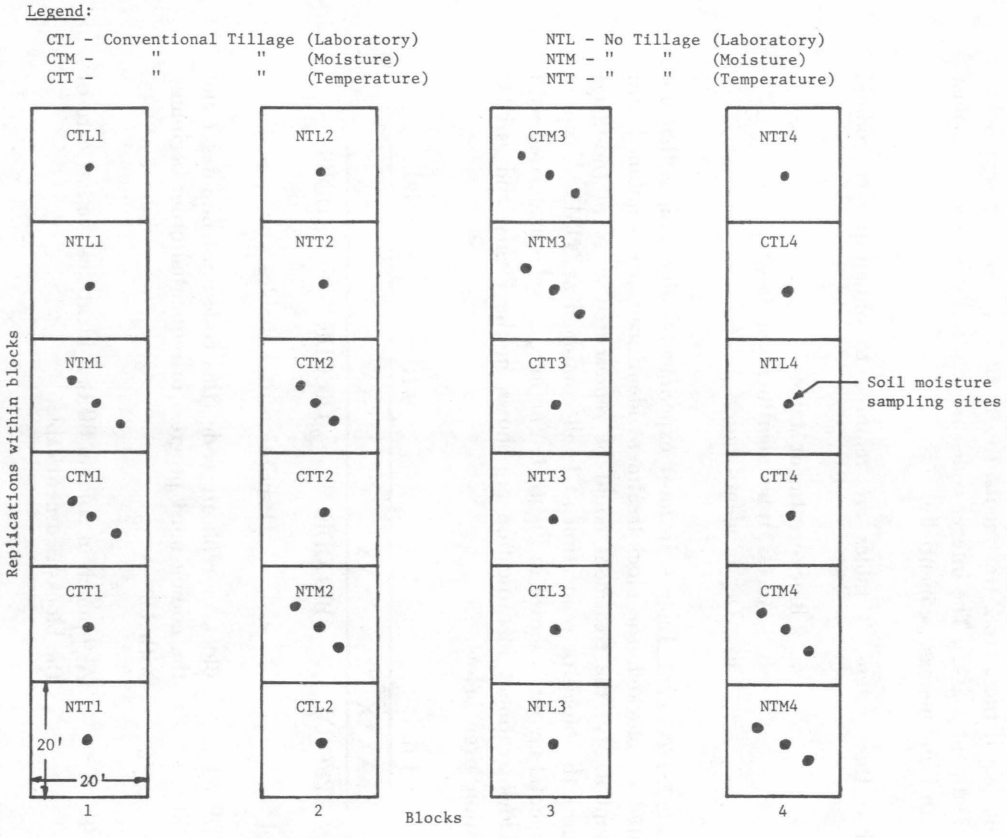


FIGURE 1 -- Schematic Diagram of a Typical Experimental Plot Design of Two Treatments - Conventional Tillage and No Tillage - Blocked 4 Times.

Access Tube Identification Table -- This table contains the identification assigned to all access tubes located within a given plot. Only those tubes within a given plot contain differing identifications (see Figure 1). For example, in a statistically designed experiment containing 2 treatments, blocked or replicated 4 times and 3 access tubes per plot, there would be a total of 24 access tubes; however, there should be only 3 differing tube identifications, e.g. A, B, and C or 1, 2, and 3 for the three within plot tubes. An integer code is placed in columns 4-5 as shown in the following format specification and variable description.

1-3	4-5	80
XXX	XX	X
TUBET	TUBCOD	KODE9

Symbol	Description of Variables
KODE9	A 9-punch in column 80 that identified the last card of the tube identification table.
TUBCOD (I) I = 1, 50	Soil moisture access tube code number (this code must be integer and the coding must progress in sequential order beginning with 1).
TUBET (I) I = 1, 50	Tube identification. This code may contain either alphabetic or numeric information.

Depth Identification Table -- This table contains the depths at which soil moisture readings were obtained and respective DEPCOD code values. Conversion factors for converting soil moisture from percentages by volume to inches of water are given for each DEPTHT value. The format for this table followed by a description of variables is given below. Indicated decimal points are not to be keypunched because they only represent where the decimal point will be placed when the data is processed by the computer.

1-2	3-4	5-9	80
XX.	XX	XXXXX.	X
DEPTHT	DEPCOD	CONV	KODE9

Symbol	Description of Variables
CONV (I) I = 1, 15	Factor for converting percentage soil moisture for a given depth to inches of water.

DEPCOD (I) I = 1, 15 — Depth identification code (this code must be integer and the coding must progress sequentially beginning with 1).

DEPTH (I) I = 1, 15 — Depths at which soil moisture readings have been obtained, e.g. 0 (surface), 12", 24", and 36".

Parameter Cards

Two groups of parameter cards are required for proper program execution. The first group specifies such items as the location of the input data on magnetic tape, provides options for including or deleting specific functions or data, and provides the dimensions of the experimental design. The format specification for this first group of parameter cards followed by a description of variables is given below:

1-3	4-8	9-11	12-16	17-18	19-20	21-22
XXX	XXXXX	XXX	XXXXX	XX	XX	XX
BEG1	BEG2	END1	END2	KARDS	KUNIT6	KUNIT1

23-24	25-26	27-28	29-30	31-32	33-34	35-36
XX	XX	XX	XX	XX	XX	XX
NDUP	NBLKS	NTRTS	NDPS	MAXDP1	MAXDEP	NEND

37-38	39-40	
XX	XX1/	XX
NGX5	TRCOMB	NERR

1/Continue with 2 digit fields until all data have been recorded for TRCOMB. Use additional data cards as required.

Symbol	Description of Variables
BEG1	Update code
BEG2	Sequence number. BEG1 and BEG2 identify the starting point a given analysis.
END1	Update code

END2 — Data sequence number. END1 and END2 specify the end of a given analysis or group of data.

KARDS — Index code with the following 2 options:

KARDS = 0: Cards are punched for subsequent analysis of variance (Section 3)

KARDS = 1: Cards are not punched

KUNIT1 — Index code with the following 2 options:

KUNIT1 = 0: The soil moisture data will be coded, converted to inches of water and stored on S.SUO1. This variable must be set to 0 if plottings or data summaries by 3" or 6" increments are desired.

KUNIT1 = 1: The above data are not written on S.SUO1; therefore, no summaries or plottings will be made.

KUNIT6 — Index code with 2 possible options:

KUNIT6 = 0: The soil moisture data that have been coded for analysis of variance (punched cards) will be written on S.SUO6 for subsequent listing by a printer.

KUNIT6 = 1: The above option is by-passed.

MAXDEP — The maximum depth for which soil moisture readings were obtained for all treatments in each block. The same number of replications is not required.

MAXDP1 — To perform an analysis of variance for a factorial design, the same number of replications must be taken on each block-treatment combination. For example, if 3 soil moisture tubes (replicates) have been placed in each treatment, then MAXDP1 is the maximum depth at which readings were made in all 3 tubes.

NBLKS — The total number of blocks in the experiment, e.g. if the overall experiment is blocked or replicated 4 times, NBLKS would equal 4.

NDPS — The total number of levels at which soil moisture readings were obtained, e.g. if readings were taken at the surface, 12", 18", and 24" NDPS would equal 4.

NDUP — Normally, the surface moisture content is obtained at only one location within a given block-treatment combination (small plots only) and this reading is assumed to be representative for the entire treatment. As previously stated, analysis of variance computations with completely cross classified models require the same number of observations in each block-treatment combination, e.g. if comparisons are to be made between treatments at the 0 (surface), 12", and 18" depths, moisture readings must be obtained at these 3 depths from all access tubes. For situations where soil moisture observations are being obtained from more than one access tube or location per treatment and one surface observation is assumed to be representative of the entire treatment area, the missing surface readings may be obtained by duplicating the surface reading taken. This can be accomplished by setting NDUP equal to the number of access tubes located in the treatment area.

NEND — Index code which determines the end of a given analysis. The following options are available.

NEND = 8: Proceed to the next group of input data. Normally, moisture readings taken on a given day constitute a group. In a normal analysis there will be a whole series of such groups.

NEND = 9: Last group of data. When KUNIT1 has been set equal to one, all processing is terminated. At this point all data have been coded and converted to inches of water for subsequent analysis of variance computations.

NEND = 9 when KUNIT1 = 0: Processing continues with data summary and plotting options.

NEND = 99: Last group of data. No data summary of plotting options.

NERR	Index code with the following two options: NERR = 0: Data encountered on the input tape which was not referenced in the identification tables are written on S.SUO8. NERR = 1: The error output on S.SUO8 is suppressed. The NERR code is placed in the first two card columns following TRCOMB. For example, if TRCOMB ends in columns 59-60, place NERR in columns 61-62.
NGX5	The number of groups to be read times 5. A maximum of 15 GROUPS or 75 TRCOMB values may be read from each parameter card.
NTRTS	The total number of treatments in each block.
TRCOMB(NGX5) NGX5 = 1, 75	The treatments that are to be combined and averaged to form GROUPS'

The second group of parameter cards supplies the various options that are available for data summary and plotting. The 3 data summaries are: (a) a listing of accumulated total soil moisture for specific units, (b) a listing of total soil moisture by 6" increments and (c) a listing of total soil moisture by 6" increments for the treatment combinations designated by TRCOMB and averaged as GROUPS. Plottings can be made of all possible combinations of the above. The block-treatment coding previously assigned in the development of the identification tables determines the particular combination to be plotted. Four months of daily moisture readings can be plotted at 3 different depths on 1 sheet of 14-7/8 x 11 inch paper. A maximum of 4 curves, where each curve normally represents some particular treatment combination, can be plotted at each depth. Normally, better legibility results when 2 curves are plotted for comparison. The format specification for this group of parameter cards followed by a description of variables is given below.

1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16
XX	XX	XX	XX	XX	XX	XX	XX
NBLOCK	NTREAT	NBL2	NTRT2	NBL3	NTRT3	NBL4	NTRT4

17-18	19-20	21-22	23-24	25-26	27-28
XX	XX	XX	XX	XX	XX
NGRP1	NGRP2	NGRP3	NGRP4	NDT(1)	NDT(2)

29-30	31-32	33-34
XX	XX	XX
NDT(3)	NEND1	NTYPLT

Symbol	Description of Variables
NBLOCK	Block code for curve No. 1.
NBL2	Block code for curve No. 2.
NBL3	Block code for curve No. 3.
NBL4	Block code for curve No. 4.
NDT(I)	Index code that specifies what soil moisture data are to be plotted, e.g. Code 1 would be for 0"-3" depth, Code 4, 0"-12" depth when NTYPLT equals 1 (See Table 1).
NEND1	Index code which determines the end of plotting and data summary. The following options are available. NEND1 = 0: Additional curves are to be plotted. After the data specified on parameter card No. 2 are plotted, control is transferred to the next parameter card. NEND1 = 9: End of plotting. An entirely new group of soil moisture data is to be processed. NEND1 = 99: End of analysis. All processing terminates.
NGRP2	GROUPS number to be plotted for curve No. 1 where GROUPS is an arithmetic average of the data specified in TRCOMB.
NGRP2	Same as NGRP1 except for curve No. 2.

TABLE 1 -- Codes to Identify the Depth at which Moisture Data is being Plotted

Code (NDT)	Depths for Total Accumulated Soil Moisture (Inches)	Depths for Total Soil Moisture (Inches)	Total Soil Moisture for Groups (Inches)
1	0-3	0-6	0-6
4	0-6	6-12	6-12
3	0-9	12-18	12-18
4	0-12	18-24	18-24
5	0-15	24-30	24-30
6	0-18	30-36	30-36
7	0-21	36-42	36-42
8	0-24	42-48	42-48
9	0-27	48-54	48-54
10	0-30	54-60	54-60
11	0-36	60-66	60-66
12	0-42	66-72	66-72
13	0-48		
14	0-54		
15	0-60		
16	0-66		
17	0-72		

NGRP3 Same as NGRP1 except for curve No. 3.

NGRP4 Same as NGRP1 except for curve No. 4.

NTYPLT Index code for plotting option. The options available are:

NTYPLT = 1: Plotting of accumulated total soil moisture for specified block-treatment and depth combinations.

NTYPLT = 2: Plottings of total soil moisture for specified block-treatment combinations at given 6" increments.

NTYPLT = 3: Plottings of combined treatments at given 6" increments.

NTYPLT = 4: Plottings of accumulated total soil moisture for the combined treatments.

NTREAT Treatment code for curve No. 1.

NTRT2 Treatment code for curve No. 2.

NTRT3 Treatment code for curve No. 3.

NTRT4 Treatment code for curve No. 4.

Basic Data

The basic input data normally will be on magnetic tape, and for the system being discussed, result from Section 1. The input required for Section 1 and the resulting output is given in Appendixes A1, A2, and A3.

The basic input data must be loaded on S.SUOO. The format of this data and a description of the variables follows:

7-12	13-15	16-19	21-26	29-31	34-38	39-40
+XXXXX	+XX	+XXX	XXXXXX	XXX	XXXX.	XX
MO	ND	NYR	ASITE	ATEBE	ATEM1	ATEM2

105-116	125-127	128-132
+XXXXXXXX.XX	XXX	XXXXX
PCMOIS	ANUP	ANCONT

Symbol	Description of Variables
ANCONT	Sequence number of basic input data.
ANUP	Update code.
ASITE	Block-treatment identification.
ATEBE	Soil moisture access tube identification.
ATEM1	Depth at which soil moisture reading was taken.
ATEM2	Units for the ATEM1 readings. In this program, the units must be either inches or feet. These designations are given as IN for inches and FT for feet.
MO	Month
ND	Day
NYR	Year
PCMOIS	Percentage moisture by volume.

PROGRAM CONSTANTS

A number of program constants are developed within the computer program to facilitate program execution and development. The constants used may be found in the data statements given in Appendix B1. A description of the variable names can be found in Appendix B2.

DATA PREPARATION

The 4 general types of data that must be prepared prior to the execution of Section 2 are (a) basic input data, (b) identification tables, and (c) two groups of parameter cards. Examples of how these data are prepared for analysis follow.

Basic input data -- The basic input data for Section 2 (Table 2) are obtained from the output of Section 1. The abbreviated sample of data presented in Table 2 is for an experimental study or comparison of the difference in soil moisture content between a conventional tillage practice

TABLE 2 -- Abbreviated Display of Data Resulting from Section 1 To Be Used to Illustrate Data Preparation and Results for Section 2.

1300	5	21	66	NTM1	1	12IN	9477.	9514.	-0.	-0.	-0.	18991.	9495.5	69.17	32.60	TIL	1
1300	5	21	66	NTM1	1	18IN	-0.	10899.	11052.	-0.	-0.	21951.	10975.5	79.96	38.37	TIL	2
1300	5	21	66	NTM1	1	24IN	-0.	11689.	11756.	-0.	-0.	23445.	11722.5	85.40	41.04	TIL	3
1300	5	21	66	NTM1	1	36IN	10372.	10503.	-0.	-0.	-0.	20875.	10437.5	76.04	36.02	TIL	4
1300	5	21	66	NTM1	1	48IN	11878.	11932.	-0.	-0.	-0.	23810.	11905.0	86.73	42.74	TIL	5
1300	5	21	66	NTM1	2	12IN	8342.	8318.	-0.	-0.	-0.	16660.	8330.0	60.68	27.31	TIL	6
1300	5	21	66	NTM1	2	18IN	9758.	9841.	-0.	-0.	-0.	19599.	9799.5	71.39	33.23	TIL	7
1300	5	21	66	NTM1	2	24IN	-0.	10953.	11028.	-0.	-0.	21981.	10990.5	80.07	38.44	TIL	8
1300	5	21	66	NTM1	2	36IN	12178.	12241.	-0.	-0.	-0.	24419.	12209.5	88.95	44.16	TIL	9
1300	5	21	66	NTM1	2	48IN	11013.	10964.	-0.	-0.	-0.	21977.	10988.5	80.05	38.43	TIL	10
1300	5	21	66	NTM1	3	12IN	8089.	8129.	-0.	-0.	-0.	16218.	8109.0	59.07	26.44	TIL	11
1300	5	21	66	NTM1	3	18IN	10501.	10321.	-0.	-0.	-0.	20822.	10411.0	75.84	35.88	TIL	12
1300	5	21	66	NTM1	3	24IN	12126.	12210.	-0.	-0.	-0.	24336.	12168.0	88.64	43.92	TIL	13
1300	5	21	66	NTM1	3	36IN	12858.	12975.	-0.	-0.	-0.	25833.	12916.5	94.10	47.66	TIL	14
1300	5	21	66	NTM1	3	48IN	12875.	12723.	-0.	-0.	-0.	25598.	12799.0	93.24	46.99	TIL	15
1300	5	21	66	CTM1	1	12IN	9796.	9949.	-0.	-0.	-0.	19745.	9872.5	71.92	33.55	TIL	16
1300	5	21	66	CTM1	1	18IN	-0.	12007.	11882.	-0.	-0.	23889.	11944.5	87.02	42.91	TIL	17
1300	5	21	66	CTM1	1	24IN	12363.	12520.	-0.	-0.	-0.	24883.	12441.5	90.64	45.28	TIL	18
1300	5	21	66	CTM1	1	36IN	13822.	13815.	-0.	-0.	-0.	27637.	13818.5	100.67	52.13	TIL	19
1300	5	21	66	CTM1	1	48IN	14402.	14536.	-0.	-0.	-0.	28938.	14469.0	105.41	55.63	TIL	20
1300	5	21	66	CTM1	2	12IN	-0.	8770.	8783.	-0.	-0.	17553.	8776.5	63.94	29.06	TIL	21
1300	5	21	66	CTM1	2	18IN	11035.	11035.	-0.	-0.	-0.	22070.	11035.0	80.39	38.63	TIL	22
1300	5	21	66	CTM1	2	24IN	12590.	12672.	-0.	-0.	-0.	25262.	12631.0	92.02	46.21	TIL	23
1300	5	21	66	CTM1	2	36IN	13919.	13848.	-0.	-0.	-0.	27767.	13883.5	101.14	52.48	TIL	24
1300	5	21	66	CTM1	2	48IN	13672.	-0.	13763.	-0.	-0.	27435.	13717.5	99.93	51.65	TIL	25
1300	5	21	66	CTM1	3	12IN	10286.	10444.	-0.	-0.	-0.	20730.	10365.0	75.51	35.61	TIL	26
1300	5	21	66	CTM1	3	18IN	-0.	11898.	11977.	-0.	-0.	23875.	11937.5	86.96	42.88	TIL	27
1300	5	21	66	CTM1	3	24IN	12698.	12562.	-0.	-0.	-0.	25260.	12630.0	92.01	46.21	TIL	28
1300	5	21	66	CTM1	3	36IN	12899.	12776.	-0.	-0.	-0.	25675.	12837.5	93.52	47.22	TIL	29
1300	5	21	66	CTM1	3	48IN	12236.	12427.	-0.	-0.	-0.	24663.	12331.5	89.84	44.70	TIL	30
1300	5	21	66	NTM2	3	12IN	8981.	9128.	-0.	-0.	-0.	18109.	9054.5	65.96	30.28	TIL	31
1300	5	21	66	NTM2	3	18IN	11193.	11277.	-0.	-0.	-0.	22470.	11235.0	81.85	39.61	TIL	32
1300	5	21	66	NTM2	3	24IN	12721.	12522.	-0.	-0.	-0.	25243.	12621.5	91.95	46.16	TIL	33
1300	5	21	66	NTM4	1	12IN	6544.	-0.	-0.	-0.	-0.	6544.	6544.0	47.67	20.80	TIL	116
1300	5	21	66	NTM4	1	18IN	7835.	-0.	-0.	-0.	-0.	7835.	7835.0	57.08	25.43	TIL	117
1300	5	21	66	NTM4	1	24IN	11330.	-0.	-0.	-0.	-0.	11330.	11330.0	82.54	40.02	TIL	118
1300	5	21	66	NTM4	1	36IN	13338.	-0.	-0.	-0.	-0.	13338.	13338.0	97.17	49.73	TIL	119
1300	5	21	66	NTM4	1	48IN	13950.	-0.	-0.	-0.	-0.	13950.	13950.0	101.63	52.83	TIL	120
1300	5	30	66	NTM1	3	12IN	8291.	8366.	-0.	-0.	-0.	16657.	8328.5	59.64	26.78	TIL	121
1300	5	30	66	NTM1	3	18IN	10968.	10912.	-0.	-0.	-0.	21880.	10940.0	78.34	37.40	TIL	122
1300	5	30	66	NTM1	3	24IN	12145.	12260.	-0.	-0.	-0.	24405.	12202.5	87.38	43.13	TIL	123
1300	5	30	66	NTM1	3	36IN	13117.	-0.	13071.	-0.	-0.	26188.	13094.0	93.76	47.41	TIL	124
1300	5	30	66	NTM1	3	48IN	12834.	12793.	-0.	-0.	-0.	25627.	12813.5	91.75	46.00	TIL	125
1300	5	30	66	CTM4	3	36IN	15005.	-0.	-0.	-0.	-0.	15005.	15005.0	107.44	57.16	TIL	239
1300	5	30	66	CTM4	3	48IN	14625.	-0.	-0.	-0.	-0.	14625.	14625.0	104.72	55.13	TIL	240
1300	5	30	66	CTM4		0IN	-0.	-0.	5934.	5931.	-0.	11865.	5932.5	58.95	10.36	TIL	241
1300	5	30	66	NTM4		0IN	-0.	-0.	7376.	7186.	-0.	14562.	7281.0	72.35	21.58	TIL	242
1300	5	30	66	NTM3		0IN	-0.	-0.	7309.	7330.	-0.	14639.	7319.5	72.74	21.89	TIL	243
1300	5	30	66	CTM3		0IN	-0.	-0.	6228.	6052.	-0.	12280.	6140.0	61.02	12.91	TIL	244
1300	5	30	66	CTM2		0IN	-0.	-0.	6321.	6155.	-0.	12476.	6238.0	61.99	12.79	TIL	245
1300	5	30	66	NTM2		0IN	-0.	-0.	7437.	7263.	-0.	14700.	7350.0	73.04	22.13	TIL	246
1300	5	30	66	CTM1		0IN	-0.	-0.	6078.	6069.	-0.	12147.	6073.5	60.35	11.48	TIL	247
1300	5	30	66	NTM1		0IN	-0.	-0.	7217.	7279.	-0.	14496.	7248.0	72.03	21.52	TIL	248
1300	6	11	66	NTM1	3	12IN	7913.	7953.	-0.	-0.	-0.	15866.	7933.0	56.79	25.28	TIL	249
1300	6	11	66	NTM1	3	18IN	10432.	10471.	-0.	-0.	-0.	20903.	10451.5	74.82	35.29	TIL	250
1300	6	11	66	NTM1	3	24IN	-0.	12177.	12168.	-0.	-0.	24345.	12172.5	87.14	42.99	TIL	251
1300	6	11	66	NTM1	3	36IN	-0.	12892.	13004.	-0.	-0.	25896.	12948.0	92.69	46.02	TIL	252
1300	6	11	66	NTM1	3	48IN	12865.	13007.	-0.	-0.	-0.	25872.	12936.0	92.61	46.37	TIL	253

TABLE 2 -- Continued (1)

1300	6	16	66	CTM2		0IN	5736.	-0.	-0.	-0.	-0.	5736.	5736.0	57.47	9.08	TIL	501
1300	6	16	66	NTM2		0IN	6654.	-0.	-0.	-0.	-0.	6654.	6654.0	66.67	16.63	TIL	502
1300	6	16	66	CTM1		0IN	5560.	-0.	-0.	-0.	-0.	5560.	5560.0	55.71	7.66	TIL	503
1300	6	16	66	NTM1		0IN	6349.	-0.	-0.	-0.	-0.	6349.	6349.0	63.61	14.11	TIL	504
1300	6	20	66	NTM1	1	12IN	8345.	-0.	-0.	-0.	-0.	8345.	8345.0	68.52	34.42	TIL	505
1300	6	20	66	NTM1	1	18IN	9915.	-0.	-0.	-0.	-0.	9915.	9915.0	81.42	41.73	TIL	506
1300	6	20	66	NTM1	1	24IN	10549.	-0.	-0.	-0.	-0.	10549.	10549.0	86.62	44.68	TIL	507
1300	6	20	66	NTM1	1	36IN	9000.	-0.	-0.	-0.	-0.	9000.	9000.0	73.90	37.47	TIL	508
1300	6	20	66	NTM1	1	48IN	10777.	-0.	-0.	-0.	-0.	10777.	10777.0	88.49	45.75	TIL	509
1300	6	20	66	NTM1	2	12IN	7006.	-0.	-0.	-0.	-0.	7006.	7006.0	57.53	28.19	TIL	510
1300	6	20	66	NTL3		0IN	5893.	5974.	5863.	-0.	-0.	17730.	5910.0	56.85	21.47	TIL	628
1300	6	20	66	CTL2		0IN	4608.	4619.	4673.	-0.	-0.	13900.	4633.3	44.57	13.79	TIL	629
1300	6	20	66	NTL2		0IN	5920.	5723.	5801.	-0.	-0.	17444.	5814.7	55.94	20.90	TIL	630
1300	6	20	66	CTL1		0IN	4902.	4873.	4851.	-0.	-0.	14626.	4875.3	46.90	15.25	TIL	631
1300	6	20	66	NTL1		0IN	5545.	5482.	5555.	-0.	-0.	16582.	5527.3	53.17	19.17	TIL	632
1300	6	23	66	NTM1	1	12IN	8228.	-0.	-0.	-0.	-0.	8228.	8228.0	67.61	33.90	TIL	633
1300	6	23	66	NTM1	1	18IN	9870.	-0.	-0.	-0.	-0.	9870.	9870.0	81.10	41.55	TIL	634
1300	7	1	66	CTL1		0IN	4549.	-0.	-0.	-0.	-0.	4549.	4549.0	43.43	13.08	TIL	887
1300	7	1	66	NTL1		0IN	5145.	-0.	-0.	-0.	-0.	5145.	5145.0	49.12	16.64	TIL	888
1300	7	5	66	CTL4		0IN	4552.	-0.	-0.	-0.	-0.	4552.	4552.0	43.62	13.20	TIL	889
1300	7	5	66	NTL4		0IN	4611.	-0.	-0.	-0.	-0.	4611.	4611.0	44.19	13.55	TIL	890
1300	7	5	66	NTL3		0IN	3947.	-0.	-0.	-0.	-0.	3947.	3947.0	37.82	9.58	TIL	891
1300	7	5	66	CTL3		0IN	4281.	-0.	-0.	-0.	-0.	4281.	4281.0	41.02	11.58	TIL	892
1300	7	5	66	CTL2		0IN	4457.	-0.	-0.	-0.	-0.	4457.	4457.0	42.71	12.63	TIL	893
1300	7	5	66	NTL2		0IN	4633.	-0.	-0.	-0.	-0.	4633.	4633.0	44.40	13.69	TIL	894
1300	7	5	66	CTL1		0IN	4312.	-0.	-0.	-0.	-0.	4312.	4312.0	41.32	11.76	TIL	895
1300	7	5	66	NTL1		0IN	4903.	-0.	-0.	-0.	-0.	4903.	4903.0	46.99	15.30	TIL	896
1300	7	5	66	NTM1	1	12IN	7271.	-0.	-0.	-0.	-0.	7271.	7271.0	59.96	29.57	TIL	897
1300	7	5	66	NTM1	1	18IN	9580.	-0.	-0.	-0.	-0.	9580.	9580.0	79.00	40.36	TIL	898
1300	7	5	66	NTM1	1	24IN	10191.	-0.	-0.	-0.	-0.	10191.	10191.0	84.04	43.22	TIL	899
1300	7	5	66	NTM1	1	36IN	9084.	-0.	-0.	-0.	-0.	9084.	9084.0	74.91	38.04	TIL	900
1300	7	5	66	NTM1	1	48IN	10678.	-0.	-0.	-0.	-0.	10678.	10678.0	88.05	45.50	TIL	901
1300	7	5	66	NTM1	2	12IN	5834.	-0.	-0.	-0.	-0.	5834.	5834.0	48.11	22.85	TIL	902
1300	7	5	66	NTM1	2	18IN	8662.	-0.	-0.	-0.	-0.	8662.	8662.0	71.43	36.07	TIL	903
1300	7	5	66	NTM1	2	24IN	9751.	-0.	-0.	-0.	-0.	9751.	9751.0	80.41	41.16	TIL	904
1300	7	5	66	CTM1	3	18IN	10525.	-0.	-0.	-0.	-0.	10525.	10525.0	86.79	44.78	TIL	923
1300	7	5	66	CTM1	3	24IN	11212.	-0.	-0.	-0.	-0.	11212.	11212.0	92.46	47.99	TIL	924
1300	7	5	66	CTM1	3	36IN	11477.	-0.	-0.	-0.	-0.	11477.	11477.0	94.64	49.23	TIL	925
1300	7	5	66	CTM1	3	48IN	11152.	-0.	-0.	-0.	-0.	11152.	11152.0	91.96	47.71	TIL	926
1300	7	6	66	NTM1	1	12IN	7268.	-0.	-0.	-0.	-0.	7268.	7268.0	59.77	29.46	TIL	927
1300	7	6	66	NTM1	1	18IN	9531.	-0.	-0.	-0.	-0.	9531.	9531.0	78.37	40.01	TIL	928
1300	7	6	66	NTM1	1	24IN	10246.	-0.	-0.	-0.	-0.	10246.	10246.0	84.25	43.34	TIL	929
1300	7	6	66	NTM1	1	36IN	8846.	-0.	-0.	-0.	-0.	8846.	8846.0	72.74	36.82	TIL	930
1300	7	14	66	CTL2		0IN	5009.	4815.	-0.	-0.	-0.	9824.	4912.0	46.85	15.22	TIL	1163
1300	7	14	66	NTL2		0IN	5104.	5096.	-0.	-0.	-0.	10200.	5100.0	48.64	16.34	TIL	1164
1300	7	14	66	CTL1		0IN	4884.	4765.	-0.	-0.	-0.	9649.	4824.5	46.02	14.70	TIL	1165
1300	7	14	66	NTL1		0IN	5245.	5128.	-0.	-0.	-0.	10373.	5186.5	49.47	16.85	TIL	1166
1300	7	19	66	NTM1	1	12IN	6516.	6665.	-0.	-0.	-0.	13181.	6590.5	54.51	26.48	TIL	1167
1300	7	19	66	NTM1	1	18IN	9137.	9101.	-0.	-0.	-0.	18238.	9119.0	75.42	38.33	TIL	1168
1300	7	19	66	NTM1	2	12IN	5269.	5413.	-0.	-0.	-0.	10682.	5341.0	44.17	20.62	TIL	1169
1300	7	19	66	NTM1	2	18IN	7662.	7751.	-0.	-0.	-0.	15413.	7706.5	63.74	31.71	TIL	1170
1300	7	19	66	NTM1	3	12IN	6155.	5959.	-0.	-0.	-0.	12114.	6057.0	50.10	23.98	TIL	1171
1300	7	19	66	NTM1	3	18IN	9133.	9017.	-0.	-0.	-0.	18150.	9075.0	75.06	38.13	TIL	1172
1300	7	19	66	CTM1	1	12IN	7737.	7861.	-0.	-0.	-0.	15598.	7799.0	64.50	32.14	TIL	1173
1300	7	19	66	CTM1	1	18IN	10009.	9934.	-0.	-0.	-0.	19943.	9971.5	82.47	42.33	TIL	1174

TABLE 2 -- Continued (2)

1300	7	19	66	CTM1	2	12IN	6454.	6499.	-0.	-0.	-0.	12953.	6476.5	53.56	25.94	TIL 1175
1300	7	19	66	CTM1	2	18IN	9260.	9089.	-0.	-0.	-0.	18349.	9174.5	75.88	38.59	TIL 1176
1300	7	19	66	CTM1	3	12IN	8051.	8087.	-0.	-0.	-0.	16138.	8069.0	66.74	33.41	TIL 1177
1300	7	19	66	CTM1	3	18IN	9969.	9836.	-0.	-0.	-0.	19805.	9902.5	81.90	42.01	TIL 1178
1300	7	19	66	NTM2	3	12IN	5993.	6027.	-0.	-0.	-0.	12020.	6010.0	49.71	23.76	TIL 1179
1300	7	19	66	NTM2	3	18IN	9578.	9507.	-0.	-0.	-0.	19085.	9542.5	78.92	40.32	TIL 1180
1300	7	19	66	NTM2	2	12IN	5816.	5888.	-0.	-0.	-0.	11704.	5852.0	48.40	23.02	TIL 1181
1300	7	19	66	NTM2	2	18IN	9370.	9320.	-0.	-0.	-0.	18690.	9345.0	77.29	39.39	TIL 1182
1300	7	19	66	NTM2	1	12IN	6631.	6620.	-0.	-0.	-0.	13251.	6625.5	54.80	26.64	TIL 1183
1300	7	19	66	NTM2	1	18IN	10484.	10532.	-0.	-0.	-0.	21016.	10508.0	86.91	44.85	TIL 1184
1300	7	19	66	CTM2	1	12IN	-0.	-0.	5265.	5288.	-0.	10553.	5276.5	43.64	20.32	TIL 1185
1300	7	19	66	CTM2	1	18IN	8945.	8858.	-0.	-0.	-0.	17803.	8901.5	73.62	37.31	TIL 1186
1300	7	19	66	CTL3		0IN	3531.	3577.	-0.	-0.	-0.	7108.	3554.0	34.21	7.32	TIL 1220
1300	7	19	66	CTL4		0IN	3637.	3699.	-0.	-0.	-0.	7336.	3668.0	35.31	8.00	TIL 1221
1300	7	19	66	NTL4		0IN	4227.	4220.	-0.	-0.	-0.	8447.	4223.5	40.66	11.35	TIL 1222
1300	7	22	66	NTM1	1	12IN	6419.	6559.	-0.	-0.	-0.	12978.	6489.0	52.95	25.60	TIL 1223
1300	7	22	66	NTM1	1	18IN	9004.	8901.	-0.	-0.	-0.	17905.	8952.5	73.06	36.99	TIL 1224
1300	7	22	66	NTM1	2	12IN	5204.	5185.	-0.	-0.	-0.	10389.	5194.5	42.39	19.61	TIL 1225
1300	8	2	66	CTM3	2	24IN	6645.	6761.	-0.	-0.	-0.	13406.	6703.0	54.72	26.60	TIL 1465
1300	8	2	66	CTM3	2	36IN	8700.	8784.	-0.	-0.	-0.	17484.	8742.0	71.37	36.04	TIL 1466
1300	8	2	66	CTM3	2	48IN	10160.	9832.	10076.	-0.	-0.	30068.	10022.7	81.82	41.96	TIL 1467
1300	8	2	66	NTM4	2	24IN	10566.	10532.	-0.	-0.	-0.	21098.	10549.0	86.12	44.40	TIL 1468
1300	8	2	66	NTM4	2	36IN	10908.	10950.	-0.	-0.	-0.	21858.	10929.0	89.22	46.16	TIL 1469
1300	8	2	66	NTM4	2	48IN	11089.	11001.	-0.	-0.	-0.	22090.	11045.0	90.17	46.70	TIL 1470
1300	8	5	66	NTM1	1	12IN	8897.	8803.	-0.	-0.	-0.	17700.	8850.0	72.47	36.66	TIL 1471
1300	8	5	66	NTM1	1	18IN	10100.	10012.	-0.	-0.	-0.	20112.	10056.0	82.35	42.26	TIL 1472
1300	8	5	66	NTM1	1	24IN	10565.	10677.	-0.	-0.	-0.	21242.	10621.0	86.97	44.88	TIL 1473
1300	8	5	66	NTM1	2	12IN	6675.	6876.	6784.	6881.	-0.	27216.	6804.0	55.72	27.16	TIL 1474
1300	8	5	66	NTM1	2	18IN	8406.	8398.	-0.	-0.	-0.	16804.	8402.0	68.80	34.58	TIL 1475
1300	8	5	66	NTM4	3	24IN	11319.	11541.	11420.	11498.	-0.	45778.	11444.5	93.72	48.71	TIL 1550
1300	8	5	66	NTM4	2	12IN	7354.	7526.	-0.	-0.	-0.	14880.	7440.0	60.93	30.12	TIL 1551
1300	8	5	66	NTM4	2	18IN	9367.	9411.	-0.	-0.	-0.	18778.	9389.0	76.89	39.16	TIL 1552
1300	8	5	66	NTM4	2	24IN	10635.	10463.	-0.	-0.	-0.	21098.	10549.0	86.39	44.55	TIL 1553
1300	8	5	66	NTM4	2	36IN	10891.	10875.	-0.	-0.	-0.	21766.	10883.0	89.12	46.10	TIL 1554
1300	8	5	66	NTM4	2	48IN	11255.	11285.	-0.	-0.	-0.	22540.	11270.0	92.29	47.90	TIL 1555
1300	8	5	66	NTM4	1	12IN	6174.	6223.	-0.	-0.	-0.	12397.	6198.5	50.76	24.35	TIL 1556
1300	8	5	66	NTM4	1	18IN	7495.	7303.	-0.	-0.	-0.	14798.	7399.0	60.59	29.93	TIL 1557
1300	8	5	66	NTM4	1	24IN	9986.	10083.	-0.	-0.	-0.	20069.	10034.5	82.17	42.16	TIL 1558
1300	8	5	66	CTL4		0IN	6873.	6739.	-0.	-0.	-0.	13612.	6806.0	65.29	26.74	TIL 1559
1300	8	5	66	NTL4		0IN	6471.	6608.	-0.	-0.	-0.	13079.	6539.5	62.74	25.15	TIL 1560
1300	8	5	66	CTL3		0IN	6697.	6726.	-0.	-0.	-0.	13423.	6711.5	64.39	26.18	TIL 1561
1300	8	5	66	NTL3		0IN	6297.	6175.	-0.	-0.	-0.	12472.	6236.0	59.82	23.33	TIL 1562
1300	8	5	66	CTL2		0IN	6729.	6625.	-0.	-0.	-0.	13354.	6677.0	64.05	25.97	TIL 1563
1300	8	5	66	NTL2		0IN	6626.	6723.	-0.	-0.	-0.	13349.	6674.5	64.03	25.96	TIL 1564
1300	8	5	66	CTL1		0IN	6508.	6485.	-0.	-0.	-0.	12993.	6496.5	62.32	24.89	TIL 1565
1300	8	5	66	NTL1		0IN	7007.	6855.	-0.	-0.	-0.	13862.	6931.0	66.49	27.49	TIL 1566
1300	8	9	66	NTM1	1	12IN	8226.	8377.	-0.	-0.	-0.	16603.	8301.5	68.23	34.26	TIL 1567
1300	8	9	66	NTM1	1	18IN	9701.	9751.	-0.	-0.	-0.	19452.	9726.0	79.94	40.90	TIL 1568
1300	8	9	66	NTM1	1	24IN	10450.	10628.	-0.	-0.	-0.	21078.	10539.0	86.62	44.68	TIL 1569
1300	8	9	66	NTM1	2	12IN	6827.	6852.	-0.	-0.	-0.	13679.	6839.5	56.22	27.45	TIL 1570

TABLE 3 -- Identifications and Corresponding Coding for Various Block-Treatment Combinations, Depths, and Access Tubes for No-Tillage Experiment Located at Blacksburg, Virginia.

Title	Identification	Code	
Block-Treatment	(TPFORM)	(TRCODE)	(BKCODE)
	NTM1	1	1
	CTM1	2	1
	NTM2	1	2
	CTM2	2	2
	NTM3	1	3
	CTM3	2	3
	NTM4	1	4
	CTM4	2	4
	NTL1	1	1
	CTL1	2	1
	NTL2	1	2
	CTL2	2	2
	NTL3	1	3
	CTL3	2	3
	NTL4	1	4
	CTL4	2	4
Depth	(DEPTHT)	(DEPCOD)	(CONV)
	0	1	6
	12	2	9
	18	3	6
	24	4	9
	36	5	12
	48	6	12
Access Tube	(TUBET)	(TUBCOD)	
	1	1	
	1	1	
	1	1	
	2	2	
	2	2	
	2	2	
	3	3	
	3	3	
	3	3	

and a no-tillage practice. The experiment had 2 treatments that were blocked (replicated) 4 times.

Identification tables -- The procedures for the development of the 3 identification tables are discussed on page 4, however, an example will be given for clarification. The identifications that were arbitrarily assigned to the block-treatment combination at the initiation of the experiment are given in Table 3. Initial assignments were made on a schematic layout of the experimental design (Figure 1).

Soil moisture data were obtained at the surface (0"), 12", 18", 24", 36", and 48" depths. Only one surface reading was obtained per treatment, and this reading was assumed to be representative for the entire treatment area. These readings were obtained on NLT and CTL plots and were coded identically as corresponding NTM and CTM plots. The depths or levels of moisture sampling were identified as 0, 12, 18, 24, 36, and 48 respectively. These 6 levels were coded sequentially as shown in Table 3 (DEPCOD). CONV values were obtained by linear interpolation between successive sampling points.

Three soil moisture access tubes were located in each plot and were identified as 1, 2, and 3. Any alphabetic, numeric or alphameric identification can be used (e.g. A, B, and C). The only limitation is that the number of characters making up each tube identification cannot exceed 3. The TUBET values are presented in Table 3 in 3 different locations where each location has the same TUBCOD code. This arrangement is shown to illustrate the coding parameters when TUBET has not been right justified. Routines developed in Section 1 automatically right justify TPFORM,DEPTH and TUBET, which normally eliminates the need for such an arrangement.

The integer code values assigned to the 3 tables are given in Table 3 as TRCODE, BKCODE, DEPCOD, and TUBCOD. The data presented in Table 3 have been placed on data sheets for key punching (Table 4).

Before coding the parameter cards, the variables in each must be studied as to their functions and the desired output decided upon. Examples of several options or alternatives are given in Table 5 to illustrate the utility of the program.

Example 1:

In this example, it is assumed that a complete analysis is desired, i.e. the data must be coded and punched for analysis of variance and all possible total soil moisture summaries and plottings made.

TABLE 4 -- The Identification Data Given in Table 3 After It Has Been Prepared for Key Punching.

Block-Treatment Table

1		N	T	M	1		1	1	1
2		C	T	M	1		1	2	2
3		N	T	M	2		2	1	3
4		C	T	M	2		2	2	4
5		N	T	M	3		3	1	5
6		C	T	M	3		3	2	6
7		N	T	M	4		4	1	7
8		C	T	M	4		4	2	8
9		N	T	L	1		1	1	9
10		C	T	L	1		1	2	10
11		N	T	L	2		2	1	11
12		C	T	L	2		2	2	12
13		N	T	L	3		3	1	13
14		C	T	L	3		3	2	14
15		N	T	L	4		4	1	15
16		C	T	L	4		4	2	16

Depth Table

1		0	1			6	.		1
2	1	2	2			9	.		2
3	1	8	3			6	.		3
4	2	4	4			9	.		4
5	3	6	5		1	2	.		5
6	4	8	6		1	2	.		6

Access Tube Table

1	.		1		1				1
2		1			1				2
3	1				1				3
4			2		2				4
5		2			2				5
6	2				2				6
7			3		3				7
8		3			3				8
9	3				3				9

TABLE 5 -- Example Parameter Cards That Have Been Prepared from the Input Data Given in Table 2 to Illustrate Selected Coding Options.

Example 1

```
Card  Columns 1-80
      12345678901234567890123456789012345678901234567890123456789012345678901234567890
1     TIL    1TIL  120 1 0 0 0 4 2 62448 815 1 0 0 0 0 2 0 0 0 0 1 2 0 0 0
2     TIL  121TIL  248 0 0 0 3 4 2 62448 815 1 0 0 0 0 2 0 0 0 0 1 2 0 0 0
3     TIL  505TIL  632 0 0 0 3 4 2 62448 815 1 0 0 0 0 2 0 0 0 0 1 2 0 0 0
4     TIL  889TIL  926 1 0 0 0 4 2 62448 815 1 0 0 0 0 2 0 0 0 0 1 2 0 0 0
5     TIL 1167TIL 1222 1 0 0 0 4 2 31818 815 1 0 0 0 0 2 0 0 0 0 1 2 0 0 0
6     TIL 1471TIL 1566 0 0 0 3 4 2 62448 915 1 0 0 0 0 2 0 0 0 0 1 2 0 0 0
7      1 1 1 2 0 0 0 0 0 0 0 0 1 4 6 0 1
8      2 1 2 2 0 0 0 0 0 0 0 0 1 4 6 0 1
9      1 1 1 2 0 0 0 0 0 0 0 0 1 2 3 0 2
10     2 1 2 2 0 0 0 0 0 0 0 0 1 2 3 0 2
11     0 0 0 0 0 0 0 0 1 2 0 0 1 2 5 0 3
12     0 0 0 0 0 0 0 0 3 0 0 0 1 2 599 3
```

Example 2

```
Card  Columns 1-80
      12345678901234567890123456789012345678901234567890123456789012345678901234567890
1     TIL  121TIL  248 0 1 1 3 4 2 62448 8 1
2     TIL  505TIL  632 0 1 1 3 4 2 62448 8 1
3     TIL 1471TIL 1566 0 1 1 3 4 2 6244899 1
```

Example 3

```
Card  Columns 1-80
      12345678901234567890123456789012345678901234567890123456789012345678901234567890
1     TIL    1TIL  120 1 0 0 0 4 2 64848 810 1 0 0 0 0 2 0 0 0 0
2     TIL  121TIL  248 1 0 0 0 4 2 64848 810 1 0 0 0 0 2 0 0 0 0
3     TIL  505TIL  632 1 0 0 0 4 2 64848 810 1 0 0 0 0 2 0 0 0 0
4     TIL  889TIL  926 1 0 0 0 4 2 62448 810 1 0 0 0 0 2 0 0 0 0
5     TIL 1167TIL 1222 1 0 0 0 4 2 31818 810 1 0 0 0 0 2 0 0 0 0
6     TIL 1471TIL 1566 1 0 0 0 4 2 62448 910 1 0 0 0 0 2 0 0 0 0
7      1 1 1 2 0 0 0 0 0 0 0 0 1 4 6 0 1
8      0 0 0 0 0 0 0 0 1 2 0 0 1 2 599 3
```

Example 4

```
Card  Columns 1-80
      12345678901234567890123456789012345678901234567890123456789012345678901234567890
1     TIL    1TIL  120 1 0 0 0 4 2 64848 8 1
2     TIL  121TIL  248 1 0 0 0 4 2 64848 8 1
3     TIL  505TIL  632 1 0 0 0 4 2 64848 8 1
4     TIL  889TIL  926 1 0 0 0 4 2 62448 8 1
5     TIL 1167TIL 1222 1 0 0 0 4 2 31818 8 1
6     TIL 1471TIL 1566 1 0 0 0 4 2 62448 9 1
7      1 1 1 2 2 1 2 2 0 0 0 0 1 4 699 1
```

The first and second group of parameter cards would be coded as illustrated in Table 5. Note that the data example has been selected to illustrate the procedure involved when both full and partial records are involved. For the analysis of variance procedure illustrated, no missing records are permitted; therefore, the 24" depth is the maximum depth to be included for this analysis. All data can be plotted regardless of the restrictions placed on the analysis of variance routine. Reference to the discussion starting on page 3 will clarify questions concerning coding.

Example 2:

Example 2 illustrates the coding required when only analysis of variance is desired. Note that the second group of parameter cards is not required.

Example 3:

Example 3 illustrates the coding required with no analysis of variance, but summaries and plotting are desired for total accumulated soil moisture and group combinations. Two curves are compared.

Example 4:

Example 4 illustrates the parameter cards required for 4 curves per plotting for example 3; but no treatment combination.

ORDER OF INPUT

The order of input for the IBM 7040/1401 Computer is as follows:

a. $JOB card (computer residence card)
b. $IBJOB card (computer residence card)
c. Binary deck (program instructions)
d. $ENTRY card (computer residence card)
e. Header card
f. Soil moisture tension table (required when available moisture determined)
g. Block-treatment table
h. Depth table
i. Access tube table
j. First group of parameter cards

k. Second group of parameter cards
l. Repeat steps e-i where applicable

Note that unless an entirely new experimental study is to be processed steps e through k will not be repeated. Also, note that the basic input data to Section 2 are on magnetic tape, which must be mounted on S.SUOO.

OUTPUT

The output from the system can be in many forms depending on the option specified. The form of the output from Section 1 is illustrated in Appendixes A1, A2, and A3. An example of the output that can be obtained from Section 2 is given in Tables 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, and 16. The example is also the output that would result from the coding given in Table 5.

The data given in Table 6 are simply a display of the identification tables that were sorted in the computer for the run. This output is used to double-check the identification table for errors or omissions.

If the identification for a given input value cannot be located in the dictionary, then the missing value is written on an output tape in the form given in Table 7. This routine aids in locating errors that have occured during key punching.

Table 8 is a listing of the punch cards that have been prepared for an analysis of variance. This listing is in the exact order that the data were encountered on the input tape (S.SUOO). Table 9 is a listing of the same data after rearrangement by a sorter for an analysis of variance for a complete cross classified statistical design.

The format specification for the punch card output followed by a description of the variables is given below.

1-2	3-4	5-6	7-8	9-10	20-25
XX	XX	XX	+X	+X	+XXXX
OUTIDX(1)	OUTIDX(2)	OUTIDX(3)	N5	OUTIDX(4)	NW

50-52	53-55	56-58	73-75	76-80
+XX	+XX	+XX	XXX	+XXXX
MO	ND	NYR	ANUP	NSEQ

TABLE 6 -- Identification Dictionary That Has Been Stored in the Computer Preparatory to Processing.

IDENTIFICATION DICTIONARY

BLOCK-TREATMENT

```
NTM1 1 1
CTM1 1 2
NTM2 2 1
CTM2 2 2
NTM3 3 1
CTM3 3 2
NTM4 4 1
CTM4 4 2
NTL1 1 1
CTL1 1 2
NTL2 2 1
CTL2 2 2
NTL3 3 1
CTL3 3 2
NTL4 4 1
CTL4 4 2
```

DEPTH

```
  0. 1      6.
 12. 2      9.
 18. 3      6.
 24. 4      9.
 36. 5     12.
 48. 6     12.
```

LOCATION WITHIN TREATMENT

```
   1 1
  1  1
 1   1
   2 2
  2  2
 2   2
   3 3
  3  3
 3   3
```

TABLE 7 -- Example Output For Identifications That Were Not Present in Dictionary.

```
UNDEFINED VARIABLE    6.      PIL 2503
UNDEFINED VARIABLE    6.      PIL 2508
UNDEFINED VARIABLE    6.      PIL 2513
UNDEFINED VARIABLE    6.      PIL 2518
UNDEFINED VARIABLE    6.      PIL 2523
UNDEFINED VARIABLE    6.      PIL 2528
UNDEFINED VARIABLE    6.      PIL 2533
UNDEFINED VARIABLE    6.      PIL 2538
UNDEFINED VARIABLE    6.      PIL 2543
UNDEFINED VARIABLE    6.      PIL 2548
UNDEFINED VARIABLE    6.      PIL 2553
UNDEFINED VARIABLE    6.      PIL 2558
UNDEFINED VARIABLE    6.      PIL 2563
UNDEFINED VARIABLE    6.      PIL 2568
UNDEFINED VARIABLE    6.      PIL 2573
UNDEFINED VARIABLE    6.      PIL 2578
UNDEFINED VARIABLE    6.      PIL 2583
UNDEFINED VARIABLE    6.      PIL 2588
UNDEFINED VARIABLE    6.      PIL 2593
UNDEFINED VARIABLE    6.      PIL 2598
UNDEFINED VARIABLE    6.      PIL 2603
UNDEFINED VARIABLE    6.      PIL 2608
UNDEFINED VARIABLE    6.      PIL 2613
UNDEFINED VARIABLE    6.      PIL 2618
```

TABLE 8 -- Abbreviated Listing of Punch Cards Containing Coded Soil Moisture Data for Subsequent Analysis of Variance.

2	1	1	2	3	241	5	30	66	TIL	1	2	2	3	2	2	183	5	30	66	TIL	81
3	1	1	2	3	224	5	30	66	TIL	2	3	2	3	2	2	141	5	30	66	TIL	82
4	1	1	2	3	388	5	30	66	TIL	3	4	2	3	2	2	224	5	30	66	TIL	83
2	1	1	2	2	248	5	30	66	TIL	6	2	2	3	2	3	200	5	30	66	TIL	86
3	1	1	2	2	199	5	30	66	TIL	7	3	2	3	2	3	142	5	30	66	TIL	87
4	1	1	2	2	340	5	30	66	TIL	8	4	2	3	2	3	241	5	30	66	TIL	88
2	1	1	2	1	287	5	30	66	TIL	11	2	1	4	2	1	217	5	30	66	TIL	91
3	1	1	2	1	227	5	30	66	TIL	12	3	1	4	2	1	145	5	30	66	TIL	92
4	1	1	2	1	371	5	30	66	TIL	13	4	1	4	2	1	328	5	30	66	TIL	93
2	2	1	2	1	282	5	30	66	TIL	16	2	1	4	2	2	235	5	30	66	TIL	96
3	2	1	2	1	255	5	30	66	TIL	17	3	1	4	2	2	219	5	30	66	TIL	97
4	2	1	2	1	403	5	30	66	TIL	18	4	1	4	2	2	390	5	30	66	TIL	98
2	2	1	2	2	250	5	30	66	TIL	21	2	1	4	2	3	238	5	30	66	TIL	101
3	2	1	2	2	233	5	30	66	TIL	22	3	1	4	2	3	215	5	30	66	TIL	102
4	2	1	2	2	409	5	30	66	TIL	23	4	1	4	2	3	400	5	30	66	TIL	103
2	2	1	2	3	309	5	30	66	TIL	26	2	2	4	2	1	178	5	30	66	TIL	106
3	2	1	2	3	251	5	30	66	TIL	27	3	2	4	2	1	146	5	30	66	TIL	107
4	2	1	2	3	405	5	30	66	TIL	28	4	2	4	2	1	369	5	30	66	TIL	108
2	2	2	2	3	257	5	30	66	TIL	31	2	2	4	2	2	208	5	30	66	TIL	111
3	2	2	2	3	239	5	30	66	TIL	32	3	2	4	2	2	205	5	30	66	TIL	112
4	2	2	2	3	422	5	30	66	TIL	33	4	2	4	2	2	410	5	30	66	TIL	113
2	2	2	2	2	220	5	30	66	TIL	36	2	2	4	2	3	237	5	30	66	TIL	116
3	2	2	2	2	207	5	30	66	TIL	37	3	2	4	2	3	242	5	30	66	TIL	117
4	2	2	2	2	411	5	30	66	TIL	38	4	2	4	2	3	417	5	30	66	TIL	118
2	2	2	2	1	217	5	30	66	TIL	41	1	2	4	2	1	62	5	30	66	TIL	121
3	2	2	2	1	206	5	30	66	TIL	42	1	2	4	2	2	62	5	30	66	TIL	122
4	2	2	2	1	398	5	30	66	TIL	43	1	2	4	2	3	62	5	30	66	TIL	123
2	1	2	2	1	256	5	30	66	TIL	46	1	1	4	2	1	129	5	30	66	TIL	124
3	1	2	2	1	265	5	30	66	TIL	47	1	1	4	2	2	129	5	30	66	TIL	125
4	1	2	2	1	435	5	30	66	TIL	48	1	1	4	2	3	129	5	30	66	TIL	126
2	1	2	2	2	263	5	30	66	TIL	51	1	1	3	2	1	131	5	30	66	TIL	127
3	1	2	2	2	230	5	30	66	TIL	52	1	1	3	2	2	131	5	30	66	TIL	128
4	1	2	2	2	405	5	30	66	TIL	53	1	1	3	2	3	131	5	30	66	TIL	129
2	1	2	2	3	244	5	30	66	TIL	56	1	2	3	2	1	72	5	30	66	TIL	130
3	1	2	2	3	229	5	30	66	TIL	57	1	2	3	2	2	72	5	30	66	TIL	131
4	1	2	2	3	415	5	30	66	TIL	58	1	2	3	2	3	72	5	30	66	TIL	132
2	1	3	2	1	205	5	30	66	TIL	61	1	2	2	2	1	76	5	30	66	TIL	133
3	1	3	2	1	144	5	30	66	TIL	62	1	2	2	2	2	76	5	30	66	TIL	134
4	1	3	2	1	212	5	30	66	TIL	63	1	2	2	2	3	76	5	30	66	TIL	135
2	1	3	2	2	189	5	30	66	TIL	66	1	1	2	2	1	132	5	30	66	TIL	136
3	1	3	2	2	133	5	30	66	TIL	67	1	1	2	2	2	132	5	30	66	TIL	137
4	1	3	2	2	203	5	30	66	TIL	68	1	1	2	2	3	132	5	30	66	TIL	138
2	1	3	2	3	196	5	30	66	TIL	71	1	2	1	2	1	68	5	30	66	TIL	139
3	1	3	2	3	140	5	30	66	TIL	72	1	2	1	2	2	68	5	30	66	TIL	140
4	1	3	2	3	212	5	30	66	TIL	73	1	2	1	2	3	68	5	30	66	TIL	141
2	2	3	2	1	188	5	30	66	TIL	76	1	1	1	2	1	127	5	30	66	TIL	142
3	2	3	2	1	133	5	30	66	TIL	77	1	1	1	2	2	127	5	30	66	TIL	143
4	2	3	2	1	185	5	30	66	TIL	78	1	1	1	2	3	127	5	30	66	TIL	144

TABLE 9 -- Abbreviated Listing of the Data Given in Table 8 after Being Sorted for Analysis of Variance for a Completely Cross-Classified Statistical Design.

1 1 1 2 1	127	5 30 66	TIL 142	1 1 3 2 2	131	5 30 66	TIL 128
2 1 1 2 1	287	5 30 66	TIL 11	2 1 3 2 2	189	5 30 66	TIL 66
3 1 1 2 1	227	5 30 66	TIL 12	3 1 3 2 2	133	5 30 66	TIL 67
4 1 1 2 1	371	5 30 66	TIL 13	4 1 3 2 2	203	5 30 66	TIL 68
1 2 1 2 1	68	5 30 66	TIL 139	1 2 3 2 2	72	5 30 66	TIL 131
2 2 1 2 1	282	5 30 66	TIL 16	2 2 3 2 2	183	5 30 66	TIL 81
3 2 1 2 1	255	5 30 66	TIL 17	3 2 3 2 2	141	5 30 66	TIL 82
4 2 1 2 1	403	5 30 66	TIL 18	4 2 3 2 2	224	5 30 66	TIL 83
1 1 2 2 1	132	5 30 66	TIL 136	1 1 4 2 2	129	5 30 66	TIL 125
2 1 2 2 1	256	5 30 66	TIL 46	2 1 4 2 2	235	5 30 66	TIL 96
3 1 2 2 1	265	5 30 66	TIL 47	3 1 4 2 2	219	5 30 66	TIL 97
4 1 2 2 1	435	5 30 66	TIL 48	4 1 4 2 2	390	5 30 66	TIL 98
1 2 2 2 1	76	5 30 66	TIL 133	1 2 4 2 2	62	5 30 66	TIL 122
2 2 2 2 1	217	5 30 66	TIL 41	2 2 4 2 2	208	5 30 66	TIL 111
3 2 2 2 1	206	5 30 66	TIL 42	3 2 4 2 2	205	5 30 66	TIL 112
4 2 2 2 1	398	5 30 66	TIL 43	4 2 4 2 2	410	5 30 66	TIL 113
1 1 3 2 1	131	5 30 66	TIL 127	1 1 1 2 3	127	5 30 66	TIL 144
2 1 3 2 1	205	5 30 66	TIL 61	2 1 1 2 3	241	5 30 66	TIL 1
3 1 3 2 1	144	5 30 66	TIL 62	3 1 1 2 3	224	5 30 66	TIL 2
4 1 3 2 1	212	5 30 66	TIL 63	4 1 1 2 3	388	5 30 66	TIL 3
1 2 3 2 1	72	5 30 66	TIL 130	1 2 1 2 3	68	5 30 66	TIL 141
2 2 3 2 1	188	5 30 66	TIL 76	2 2 1 2 3	309	5 30 66	TIL 26
3 2 3 2 1	133	5 30 66	TIL 77	3 2 1 2 3	251	5 30 66	TIL 27
4 2 3 2 1	185	5 30 66	TIL 78	4 2 1 2 3	405	5 30 66	TIL 28
1 1 4 2 1	129	5 30 66	TIL 124	1 1 2 2 3	132	5 30 66	TIL 138
2 1 4 2 1	217	5 30 66	TIL 91	2 1 2 2 3	244	5 30 66	TIL 56
3 1 4 2 1	145	5 30 66	TIL 92	3 1 2 2 3	229	5 30 66	TIL 57
4 1 4 2 1	328	5 30 66	TIL 93	4 1 2 2 3	415	5 30 66	TIL 58
1 2 4 2 1	62	5 30 66	TIL 121	1 2 2 2 3	76	5 30 66	TIL 135
2 2 4 2 1	178	5 30 66	TIL 106	2 2 2 2 3	257	5 30 66	TIL 31
3 2 4 2 1	146	5 30 66	TIL 107	3 2 2 2 3	239	5 30 66	TIL 32
4 2 4 2 1	369	5 30 66	TIL 108	4 2 2 2 3	422	5 30 66	TIL 33
1 1 1 2 2	127	5 30 66	TIL 143	1 1 3 2 3	131	5 30 66	TIL 129
2 1 1 2 2	248	5 30 66	TIL 6	2 1 3 2 3	196	5 30 66	TIL 71
3 1 1 2 2	199	5 30 66	TIL 7	3 1 3 2 3	140	5 30 66	TIL 72
4 1 1 2 2	340	5 30 66	TIL 8	4 1 3 2 3	212	5 30 66	TIL 73
1 2 1 2 2	68	5 30 66	TIL 140	1 2 3 2 3	72	5 30 66	TIL 132
2 2 1 2 2	250	5 30 66	TIL 21	2 2 3 2 3	200	5 30 66	TIL 86
3 2 1 2 2	233	5 30 66	TIL 22	3 2 3 2 3	142	5 30 66	TIL 87
4 2 1 2 2	409	5 30 66	TIL 23	4 2 3 2 3	241	5 30 66	TIL 88
1 1 2 2 2	132	5 30 66	TIL 137	1 1 4 2 3	129	5 30 66	TIL 126
2 1 2 2 2	263	5 30 66	TIL 51	2 1 4 2 3	238	5 30 66	TIL 101
3 1 2 2 2	230	5 30 66	TIL 52	3 1 4 2 3	215	5 30 66	TIL 102
4 1 2 2 2	405	5 30 66	TIL 53	4 1 4 2 3	400	5 30 66	TIL 103
1 2 2 2 2	76	5 30 66	TIL 134	1 2 4 2 3	62	5 30 66	TIL 123
2 2 2 2 2	220	5 30 66	TIL 36	2 2 4 2 3	237	5 30 66	TIL 116
3 2 2 2 2	207	5 30 66	TIL 37	3 2 4 2 3	242	5 30 66	TIL 117
4 2 2 2 2	411	5 30 66	TIL 38	4 2 4 2 3	417	5 30 66	TIL 118

Symbol	Description of Variables
ANUP	Update code
MO	Month
N5	Date code (this integer code is assigned sequentially by the computer beginning with the date of the first group of observations as 1).
ND	Day
NSEQ	Sequence number
NW	Observed moisture content times 100 for the applicable range in the soil profile (See CONV Table 4)
NYR	Year
OUTIDX(1)	DEPCOD - Depth Code
OUTIDX(2)	TRCODE - Treatment Code
OUTIDX(3)	BKCODE - Block Code
OUTIDX(4)	TUBCOD - Access tube code

If the punch card data is not needed (no statistical analysis to follow), a listing of the data can be obtained (Table 10) which will show the coding and the conversion of percentage moisture to inches of water. Variable KUNIT1 controls this option. The listing contains the following output.

Column Heading From Table 10	Symbol	Description
1	OUTIDX(1)	DEPCOD
2	OUTIDX(2)	TRCODE
3	OUTIDX(3)	BKCODE
4	N5	Date Code
5	OUTIDX(4)	TUBCOD
6	WATER	Observed moisture content in inches for applicable soil region

TABLE 10 -- Abbreviated Listing of Optional Output When Punch Cards Are Not Required for Analysis of Variance.

SORT CODE	TOTAL WATER FOR HORIZON	DATE OF RDG	SEQ NO.
2 1 1 2 3	2.41	5 30 66	TIL 1
3 1 1 2 3	2.24	5 30 66	TIL 2
4 1 1 2 3	3.88	5 30 66	TIL 3
5 1 1 2 3	5.69	5 30 66	TIL 4
6 1 1 2 3	5.52	5 30 66	TIL 5
2 1 1 2 2	2.48	5 30 66	TIL 6
3 1 1 2 2	1.99	5 30 66	TIL 7
4 1 1 2 2	3.40	5 30 66	TIL 8
5 1 1 2 2	5.03	5 30 66	TIL 9
6 1 1 2 2	4.48	5 30 66	TIL 10
2 1 1 2 1	2.87	5 30 66	TIL 11
3 1 1 2 1	2.28	5 30 66	TIL 12
4 1 1 2 1	3.71	5 30 66	TIL 13
5 1 1 2 1	3.98	5 30 66	TIL 14
6 1 1 2 1	5.01	5 30 66	TIL 15
2 2 1 2 1	2.83	5 30 66	TIL 16
3 2 1 2 1	2.55	5 30 66	TIL 17
4 2 1 2 1	4.03	5 30 66	TIL 18
5 2 1 2 1	6.04	5 30 66	TIL 19
6 2 1 2 1	6.50	5 30 66	TIL 20
2 2 1 2 2	2.50	5 30 66	TIL 21
3 2 1 2 2	2.33	5 30 66	TIL 22
4 2 1 2 2	4.10	5 30 66	TIL 23
5 2 1 2 2	6.21	5 30 66	TIL 24
6 2 1 2 2	6.18	5 30 66	TIL 25
2 2 1 2 3	3.10	5 30 66	TIL 26
3 2 1 2 3	2.51	5 30 66	TIL 27
4 2 1 2 3	4.05	5 30 66	TIL 28
5 2 1 2 3	5.52	5 30 66	TIL 29
6 2 1 2 3	5.37	5 30 66	TIL 30
2 2 2 2 3	2.57	5 30 66	TIL 31
3 2 2 2 3	2.40	5 30 66	TIL 32
4 2 2 2 3	4.23	5 30 66	TIL 33
5 2 2 2 3	5.74	5 30 66	TIL 34
6 2 2 2 3	6.00	5 30 66	TIL 35
2 2 2 2 2	2.21	5 30 66	TIL 36
3 2 2 2 2	2.08	5 30 66	TIL 37
4 2 2 2 2	4.12	5 30 66	TIL 38
5 2 2 2 2	6.40	5 30 66	TIL 39
6 2 2 2 2	5.80	5 30 66	TIL 40
2 2 2 2 1	2.17	5 30 66	TIL 41
3 2 2 2 1	2.06	5 30 66	TIL 42
4 2 2 2 1	3.98	5 30 66	TIL 43
5 2 2 2 1	5.66	5 30 66	TIL 44
6 2 2 2 1	5.81	5 30 66	TIL 45
2 1 2 2 1	2.57	5 30 66	TIL 46
3 1 2 2 1	2.66	5 30 66	TIL 47
4 1 2 2 1	4.36	5 30 66	TIL 48
5 1 2 2 1	5.72	5 30 66	TIL 49
6 1 2 2 1	5.99	5 30 66	TIL 50
2 1 2 2 2	2.64	5 30 66	TIL 51
3 1 2 2 2	2.31	5 30 66	TIL 52
4 1 2 2 2	4.05	5 30 66	TIL 53
5 1 2 2 2	5.54	5 30 66	TIL 54
6 1 2 2 2	6.50	5 30 66	TIL 55
2 1 2 2 3	2.45	5 30 66	TIL 56
3 1 2 2 3	2.30	5 30 66	TIL 57
4 1 2 2 3	4.15	5 30 66	TIL 58
5 1 2 2 3	6.29	5 30 66	TIL 59
6 1 2 2 3	5.89	5 30 66	TIL 60
2 1 3 2 1	2.06	5 30 66	TIL 61
3 1 3 2 1	1.44	5 30 66	TIL 62
4 1 3 2 1	2.13	5 30 66	TIL 63
5 1 3 2 1	3.00	5 30 66	TIL 64
6 1 3 2 1	4.38	5 30 66	TIL 65
2 1 3 2 2	1.90	5 30 66	TIL 66
3 1 3 2 2	1.34	5 30 66	TIL 67
4 1 3 2 2	2.04	5 30 66	TIL 68
5 1 3 2 2	3.03	5 30 66	TIL 69
6 1 3 2 2	4.11	5 30 66	TIL 70
2 1 3 2 3	1.97	5 30 66	TIL 71
3 1 3 2 3	1.41	5 30 66	TIL 72
4 1 3 2 3	2.13	5 30 66	TIL 73
5 1 3 2 3	3.17	5 30 66	TIL 74
6 1 3 2 3	4.83	5 30 66	TIL 75
2 2 3 2 1	1.89	5 30 66	TIL 76
3 2 3 2 1	1.33	5 30 66	TIL 77
4 2 3 2 1	1.86	5 30 66	TIL 78
5 2 3 2 1	3.74	5 30 66	TIL 79
6 2 3 2 1	5.01	5 30 66	TIL 80
2 2 3 2 2	1.83	5 30 66	TIL 81
3 2 3 2 2	1.42	5 30 66	TIL 82
4 2 3 2 2	2.25	5 30 66	TIL 83
5 2 3 2 2	3.99	5 30 66	TIL 84
6 2 3 2 2	4.62	5 30 66	TIL 85
2 2 3 2 3	2.01	5 30 66	TIL 86
3 2 3 2 3	1.43	5 30 66	TIL 87
4 2 3 2 3	2.41	5 30 66	TIL 88
5 2 3 2 3	4.39	5 30 66	TIL 89
6 2 3 2 3	3.99	5 30 66	TIL 90
2 1 4 2 1	2.18	5 30 66	TIL 91
3 1 4 2 1	1.46	5 30 66	TIL 92
4 1 4 2 1	3.28	5 30 66	TIL 93
5 1 4 2 1	5.79	5 30 66	TIL 94
6 1 4 2 1	6.14	5 30 66	TIL 95
2 1 4 2 2	2.35	5 30 66	TIL 96
3 1 4 2 2	2.20	5 30 66	TIL 97
4 1 4 2 2	3.91	5 30 66	TIL 98
5 1 4 2 2	5.12	5 30 66	TIL 99
6 1 4 2 2	5.22	5 30 66	TIL 100
2 1 4 2 3	2.39	5 30 66	TIL 101
3 1 4 2 3	2.16	5 30 66	TIL 102
4 1 4 2 3	4.01	5 30 66	TIL 103
5 1 4 2 3	6.41	5 30 66	TIL 104
6 1 4 2 3	6.79	5 30 66	TIL 105
2 2 4 2 1	1.78	5 30 66	TIL 106
3 2 4 2 1	1.47	5 30 66	TIL 107
4 2 4 2 1	3.70	5 30 66	TIL 108

TABLE 10 -- Continued

SORT CODE	TOTAL WATER FOR HORIZON	DATE OF RDG	SEQ NO.
5 2 4 2 1	6.93	5 30 66	TIL 109
6 2 4 2 1	6.93	5 30 66	TIL 110
2 2 4 2 2	2.08	5 30 66	TIL 111
3 2 4 2 2	2.05	5 30 66	TIL 112
4 2 4 2 2	4.11	5 30 66	TIL 113
5 2 4 2 2	6.59	5 30 66	TIL 114
6 2 4 2 2	6.38	5 30 66	TIL 115
2 2 4 2 3	2.37	5 30 66	TIL 116
3 2 4 2 3	2.42	5 30 66	TIL 117
4 2 4 2 3	4.18	5 30 66	TIL 118
5 2 4 2 3	6.86	5 30 66	TIL 119
6 2 4 2 3	6.62	5 30 66	TIL 120
1 2 4 2 1	0.62	5 30 66	TIL 121
1 2 4 2 2	0.62	5 30 66	TIL 122
1 2 4 2 3	0.62	5 30 66	TIL 123
1 1 4 2 1	1.29	5 30 66	TIL 124
1 1 4 2 2	1.29	5 30 66	TIL 125
1 1 4 2 3	1.29	5 30 66	TIL 126
1 1 3 2 1	1.31	5 30 66	TIL 127
1 1 3 2 2	1.31	5 30 66	TIL 128
1 1 3 2 3	1.31	5 30 66	TIL 129
1 2 3 2 1	0.72	5 30 66	TIL 130
1 2 3 2 2	0.72	5 30 66	TIL 131
1 2 3 2 3	0.72	5 30 66	TIL 132
1 2 2 2 1	0.77	5 30 66	TIL 133
1 2 2 2 2	0.77	5 30 66	TIL 134
1 2 2 2 3	0.77	5 30 66	TIL 135
1 1 2 2 1	1.33	5 30 66	TIL 136
1 1 2 2 2	1.33	5 30 66	TIL 137
1 1 2 2 3	1.33	5 30 66	TIL 138
1 2 1 2 1	0.69	5 30 66	TIL 139
1 2 1 2 2	0.69	5 30 66	TIL 140
1 2 1 2 3	0.69	5 30 66	TIL 141
1 1 1 2 1	1.28	5 30 66	TIL 142
1 1 1 2 2	1.28	5 30 66	TIL 143
1 1 1 2 3	1.28	5 30 66	TIL 144

7	MO	Month
8	ND	Day
9	NYR	Year
10	ANUP	Update Code
11	ANCONT	Sequence Number

An example of total accumulated soil moisture summary for specified increments is given in Table 11. The information contained in each column is identified by appropriate column headings. The variable name associated with each column of output, identified from left to right is given below:

Symbol	Description of Variables
I	Block Code
J	Treatment Code
ACSM(K) K = 1, 17	Total accumulated soil moisture present in the soil profile for a given block and treatment combination.
MO	Month
ND	Day
NYR	Year

The total soil moisture for 6" increments is given in Table 12. The variable name associated with each column of output, identified from left to right, is given below:

Symbol	Description of Variables
I	Block Code
J	Treatment Code
ACC(LOM) LOM = 1, 12	Total soil moisture for specified 6" increments.
MO	Month
ND	Day
NYR	Year

TABLE 11 -- Total Accumulated Soil Moisture Summary for the Input Data Given in Table 2.

BLOCK	TREATMENT	ACCUMULATED TOTAL SOIL MOISTURE FROM 0 TO																DATE		
		3IN	6IN	9IN	12IN	15IN	18IN	21IN	24IN	27IN	30IN	36IN	42IN	48IN	54IN	60IN	66IN	72IN	MO	DAY	YR
1	1	0.86	1.72	2.57	3.43	4.29	5.36	6.44	7.68	8.92	10.16	12.72	15.28	17.84					5	21	66
1	2	0.98	1.96	2.95	3.93	4.91	6.15	7.40	8.78	10.15	11.53	14.57	17.61	20.65					5	21	66
2	1	0.92	1.84	2.76	3.68	4.59	5.83	7.07	8.48	9.90	11.32	14.26	17.21	20.39					5	21	66
2	2	0.85	1.71	2.56	3.42	4.27	5.41	6.54	7.96	9.37	10.78	13.79	16.80	19.78					5	21	66
3	1	0.65	1.30	1.95	2.60	3.26	3.95	4.65	5.36	6.07	6.78	8.34	9.90	12.17					5	21	66
3	2	0.67	1.34	2.00	2.67	3.34	4.05	4.75	5.53	6.30	7.08	9.16	11.25	13.57					5	21	66
4	1	0.77	1.53	2.30	3.06	3.83	4.85	5.87	7.20	8.52	9.84	12.81	15.77	18.86					5	21	66
4	2	0.81	1.61	2.42	3.23	4.03	5.24	6.45	7.95	9.45	10.95	14.51	18.06	21.48					5	21	66
1	1	0.64	1.28	2.14	3.00	3.87	4.95	6.04	7.26	8.48	9.70	12.15	14.60	17.10					5	30	66
1	2	0.34	0.69	1.63	2.56	3.50	4.73	5.96	7.32	8.67	10.02	12.98	15.95	18.95					5	30	66
2	1	0.66	1.33	2.18	3.03	3.88	5.09	6.31	7.70	9.10	10.49	13.42	16.34	19.41					5	30	66
2	2	0.38	0.77	1.54	2.31	3.09	4.18	5.27	6.64	8.01	9.38	12.34	15.31	18.24					5	30	66
3	1	0.66	1.31	1.97	2.63	3.29	3.98	4.68	5.38	6.08	6.78	8.32	9.85	12.07					5	30	66
3	2	0.36	0.72	1.36	1.99	2.63	3.33	4.02	4.75	5.47	6.20	8.22	10.24	12.51					5	30	66
4	1	0.64	1.29	2.06	2.83	3.60	4.57	5.54	6.78	8.03	9.27	12.16	15.04	18.07					5	30	66
4	2	0.31	0.62	1.31	2.00	2.70	3.69	4.68	6.01	7.34	8.67	12.07	15.47	18.79					5	30	66
1	1	0.58	1.15	2.09	3.03	3.97	5.17	6.38	7.70	9.03	10.35	13.03	15.71	18.46					6	20	66
1	2	0.45	0.91	2.00	3.10	4.19	5.55	6.91	8.39	9.88	11.36	14.50	17.65	20.82					6	20	66
2	1	0.63	1.25	2.30	3.36	4.41	5.78	7.15	8.68	10.21	11.73	14.81	17.89	21.11					6	20	66
2	2	0.41	0.83	1.78	2.73	3.68	4.98	6.28	7.77	9.27	10.76	13.90	17.05	20.16					6	20	66
3	1	0.64	1.29	1.96	2.62	3.29	4.04	4.79	5.57	6.35	7.13	8.92	10.72	13.18					6	20	66
3	2	0.42	0.85	1.53	2.22	2.90	3.65	4.40	5.23	6.06	6.90	9.18	11.47	14.00					6	20	66
4	1	0.64	1.28	2.11	2.94	3.77	4.93	6.08	7.57	9.06	10.55	13.66	16.77	19.96					6	20	66
4	2	0.41	0.82	1.73	2.64	3.55	4.88	6.21	7.82	9.42	11.03	14.56	18.09	21.59					6	20	66
1	1	0.46	0.92	1.70	2.48	3.27	4.41	5.56	6.85	8.15	9.44	12.13	14.83	17.59					7	5	66
1	2	0.36	0.71	1.66	2.61	3.56	4.86	6.16	7.59	9.02	10.45	13.56	16.67	19.86					7	5	66
2	1	0.41	0.82																7	5	66
2	2	0.38	0.76																7	5	66
3	1	0.29	0.57																7	5	66
3	2	0.34	0.69																7	5	66
4	1	0.41	0.81																7	5	66
4	2	0.39	0.79																7	5	66
1	1	0.32	0.64	1.35	2.06	2.77	3.85												7	19	66
1	2	0.29	0.58	1.49	2.41	3.32	4.55												7	19	66
2	1	0.39	0.78	1.51	2.25	2.98	4.23												7	19	66
2	2	0.36	0.72	1.40	2.07	2.75	3.90												7	19	66
3	1	0.38	0.75	1.13	1.51	1.89	2.52												7	19	66
3	2	0.22	0.44	0.93	1.42	1.91	2.57												7	19	66
4	1	0.34	0.68	1.24	1.81	2.37	3.37												7	19	66
4	2	0.24	0.48	1.18	1.87	2.57	3.78												7	19	66
1	1	0.83	1.65	2.59	3.54	4.48	5.63	6.78	8.07	9.37	10.66	13.30	15.95	18.35					8	5	66
1	2	0.74	1.49	2.53	3.57	4.61	5.88	7.15	8.53	9.91	11.29	14.26	17.22	20.33					8	5	66
2	1	0.78	1.56	2.54	3.52	4.51	5.83	7.15	8.62	10.10	11.58	14.53	17.48	20.81					8	5	66
2	2	0.78	1.56	2.46	3.36	4.25	5.47	6.68	8.09	9.49	10.90	14.17	17.45	20.56					8	5	66
3	1	0.70	1.40	2.07	2.74	3.41	4.11	4.82	5.54	6.26	6.98	8.56	10.14	12.27					8	5	66
3	2	0.78	1.57	2.21	2.85	3.48	4.16	4.84	5.59	6.34	7.09	9.22	11.35	13.85					8	5	66
4	1	0.75	1.51	2.39	3.26	4.14	5.24	6.35	7.71	9.06	10.41	13.18	15.94	18.82					8	5	66
4	2	0.80	1.60	2.54	3.47	4.41	5.66	6.92	8.39	9.85	11.32	14.70	18.09	21.43					8	5	66

TABLE 12 -- Total Soil Moisture at 6" Increments for the Input Data Given in Table 2.

BLOCK	TREATMENT	TOTAL SOIL MOISTURE FOR												DATE		
		00-06	06-12	12-18	18-24	24-30	30-36	36-42	42-48	48-54	54-60	60-66	66-72	MO	DA	YR
1	1	1.72	1.72	1.93	2.32	2.48	2.56	2.56	2.56					5	21	66
1	2	1.96	1.96	2.23	2.62	2.76	3.04	3.04	3.04					5	21	66
2	1	1.84	1.84	2.16	2.65	2.83	2.94	2.94	3.18					5	21	66
2	2	1.71	1.71	1.99	2.55	2.83	3.01	3.01	2.98					5	21	66
3	1	1.30	1.30	1.35	1.41	1.42	1.56	1.56	2.27					5	21	66
3	2	1.34	1.34	1.37	1.48	1.55	2.08	2.08	2.33					5	21	66
4	1	1.53	1.53	1.79	2.35	2.64	2.97	2.97	3.09					5	21	66
4	2	1.61	1.61	2.02	2.71	3.00	3.56	3.56	3.41					5	21	66
1	1	1.28	1.72	1.95	2.31	2.44	2.45	2.45	2.50					5	30	66
1	2	0.69	1.87	2.17	2.58	2.71	2.96	2.96	3.01					5	30	66
2	1	1.33	1.70	2.06	2.61	2.79	2.92	2.92	3.06					5	30	66
2	2	0.77	1.54	1.86	2.46	2.74	2.97	2.97	2.93					5	30	66
3	1	1.31	1.32	1.36	1.40	1.40	1.53	1.53	2.22					5	30	66
3	2	0.72	1.27	1.33	1.42	1.45	2.02	2.02	2.27					5	30	66
4	1	1.29	1.54	1.74	2.21	2.49	2.89	2.89	3.02					5	30	66
4	2	0.62	1.38	1.68	2.32	2.66	3.40	3.40	3.32					5	30	66
1	1	1.15	1.88	2.14	2.53	2.65	2.68	2.68	2.75					6	20	66
1	2	0.91	2.19	2.45	2.84	2.96	3.15	3.15	3.17					6	20	66
2	1	1.25	2.11	2.42	2.90	3.06	3.08	3.08	3.22					6	20	66
2	2	0.83	1.90	2.25	2.79	2.99	3.14	3.14	3.11					6	20	66
3	1	1.29	1.33	1.42	1.53	1.56	1.79	1.79	2.46					6	20	66
3	2	0.85	1.37	1.43	1.58	1.67	2.28	2.28	2.53					6	20	66
4	1	1.28	1.66	1.99	2.65	2.98	3.11	3.11	3.19					6	20	66
4	2	0.82	1.82	2.24	2.93	3.21	3.53	3.53	3.50					6	20	66
1	1	0.92	1.56	1.93	2.44	2.59	2.69	2.69	2.76					7	5	66
1	2	0.71	1.90	2.25	2.73	2.86	3.11	3.11	3.19					7	5	66
2	1	0.82												7	5	66
2	2	0.76												7	5	66
3	1	0.57												7	5	66
3	2	0.69												7	5	66
4	1	0.81												7	5	66
4	2	0.79												7	5	66
1	1	0.64	1.42	1.79										7	19	66
1	2	0.58	1.83	2.14										7	19	66
2	1	0.78	1.47	1.98										7	19	66
2	2	0.72	1.35	1.82										7	19	66
3	1	0.75	0.76	1.01										7	19	66
3	2	0.44	0.98	1.15										7	19	66
4	1	0.68	1.13	1.57										7	19	66
4	2	0.48	1.39	1.91										7	19	66
1	1	1.65	1.89	2.09	2.44	2.58	2.64	2.64	2.40					8	5	66
1	2	1.49	2.08	2.31	2.65	2.76	2.96	2.96	3.11					8	5	66
2	1	1.56	1.96	2.30	2.80	2.95	2.95	2.95	3.33					8	5	66
2	2	1.56	1.80	2.11	2.62	2.81	3.27	3.27	3.11					8	5	66
3	1	1.40	1.34	1.38	1.43	1.44	1.58	1.58	2.13					8	5	66
3	2	1.57	1.28	1.32	1.43	1.50	2.13	2.13	2.50					8	5	66
4	1	1.51	1.75	1.98	2.46	2.71	2.76	2.76	2.88					8	5	66
4	2	1.60	1.87	2.19	2.72	2.93	3.38	3.38	3.34					8	5	66

The total soil moisture for the average of various block-treatment combinations is given in Table 13. The variable name associated with each column of output identified from left to right follows:

Symbol	Description of Variables
NGP	Group Identification
NT(I) I = 1, 5	Treatments that have been summed over the entire experiment and averaged to form NGP.
GRPS(I) I = 1, 12	Average total soil moisture for specified depths.
MO	Month
ND	Day
NYR	Year

Tables 14, 15, and 16 are example plottings of the data given in Tables 11, 12, and 13. The ordinate and abscissa scales are developed by internal programming routines. The abscissa coordinate point consists of daily increments. The ordinate scale is divided into 15 equal divisions representing inches of water. A different ordinate scale is developed for each new depth being plotted. For example, the same ordinate scale is used for all treatment comparisons at the 12" depth, but a new scale is developed when plottings are made for the 18" depth.

The ordinate scale is determined from the maximum and minimum values for the particular group of data to be plotted, e.g. all data for the 12" depth. The minimum value is fixed while the maximum value is allowed to be shifted upwards until 15 even divisions are obtained. All ordinate values are to the nearest .01".

Four months of continuous soil moisture data for 3 different depths can be plotted on standard 14-7/8" x 11" paper. When the data exceeds these limits, the plotting is simply continued on the next page. Plotting is achieved by identifying coordinate points through which a curve may be quickly hand traced. In this program, a maximum of 4 curves may be plotted on 1 graph for comparison (Table 17). The coordinate point identification for each curve is given in Table 18:

TABLE 13 -- Total Soil Moisture Summary at 6" Increments for the Average of Various Block-Treatment Combinations of the Input Data Given in Table 2.

GROUP	TREATMENTS					TOTAL SOIL MOISTURE FOR												DATE		
						00-06	06-12	12-18	18-24	24-30	30-36	36-42	42-48	48-54	54-60	60-66	66-72	MO	DA	YR
1	1	0	0	0	0	1.60	1.60	1.81	2.18	2.34	2.51	2.51	2.77					5	21	66
2	2	0	0	0	0	1.66	1.66	1.90	2.34	2.53	2.92	2.92	2.94					5	21	66
3	1	2	0	0	0	1.63	1.63	1.85	2.26	2.44	2.71	2.71	2.86					5	21	66
1	1	0	0	0	0	1.30	1.57	1.78	2.13	2.28	2.45	2.45	2.70					5	30	66
2	2	0	0	0	0	0.70	1.52	1.76	2.20	2.39	2.84	2.84	2.88					5	30	66
3	1	2	0	0	0	1.00	1.54	1.77	2.16	2.34	2.64	2.64	2.79					5	30	66
1	1	0	0	0	0	1.24	1.75	1.99	2.40	2.56	2.67	2.67	2.90					6	20	66
2	2	0	0	0	0	0.85	1.82	2.09	2.54	2.71	3.03	3.03	3.08					6	20	66
3	1	2	0	0	0	1.05	1.78	2.04	2.47	2.63	2.85	2.85	2.99					6	20	66
1	1	0	0	0	0	0.78	1.56	1.93	2.44	2.59	2.69	2.69	2.76					7	5	66
2	2	0	0	0	0	0.74	1.90	2.25	2.73	2.86	3.11	3.11	3.19					7	5	66
3	1	2	0	0	0	0.76	1.73	2.09	2.59	2.72	2.90	2.90	2.97					7	5	66
1	1	0	0	0	0	0.71	1.19	1.59										7	19	66
2	2	0	0	0	0	0.55	1.39	1.76										7	19	66
3	1	2	0	0	0	0.63	1.29	1.67										7	19	66
1	1	0	0	0	0	1.53	1.74	1.94	2.28	2.42	2.48	2.48	2.68					8	5	66
2	2	0	0	0	0	1.55	1.76	1.98	2.36	2.50	2.94	2.94	3.02					8	5	66
3	1	2	0	0	0	1.54	1.75	1.96	2.32	2.46	2.71	2.71	2.85					8	5	66

TABLE 14 -- Example Plottings of the Data Given in Table 11 for 2 Combinations (Block 1 - Treatments 1 and 2 and Block 2 - Treatments 1 and 2) at Depths 0"-3", 0"-12" and 0"-18".

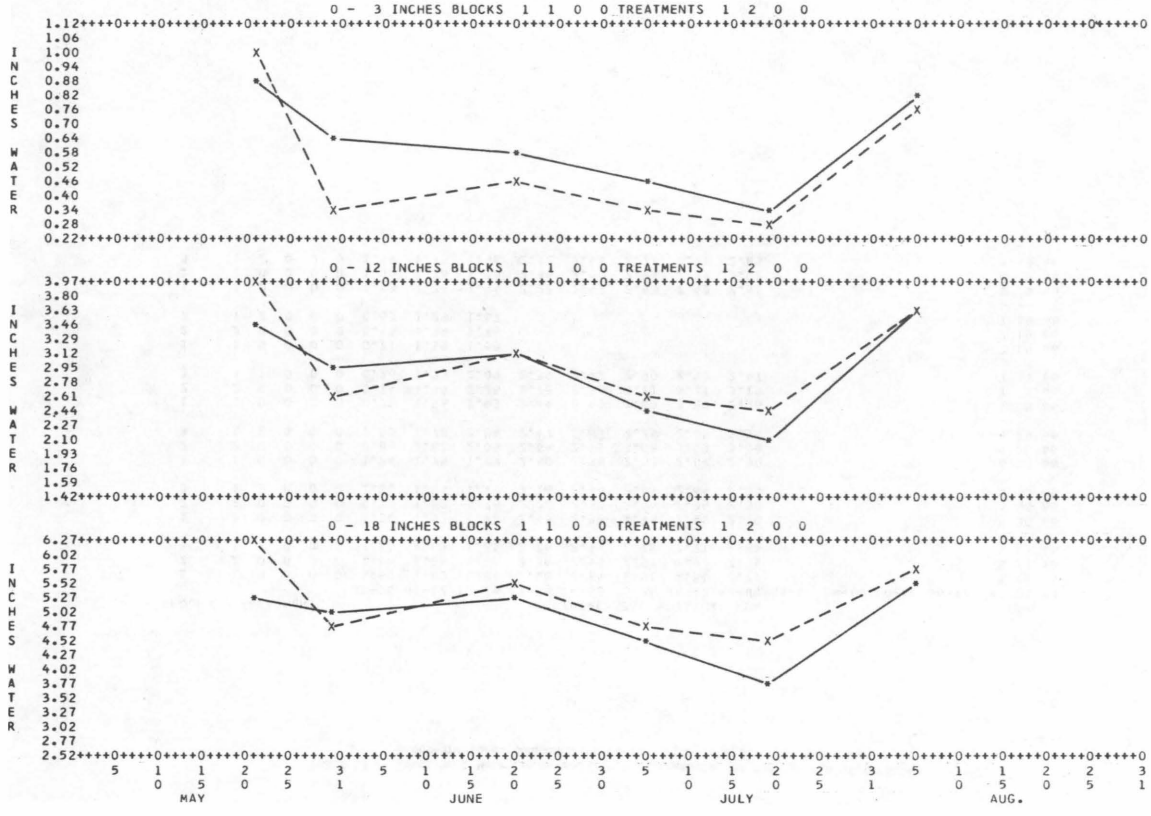


TABLE 14 -- Continued

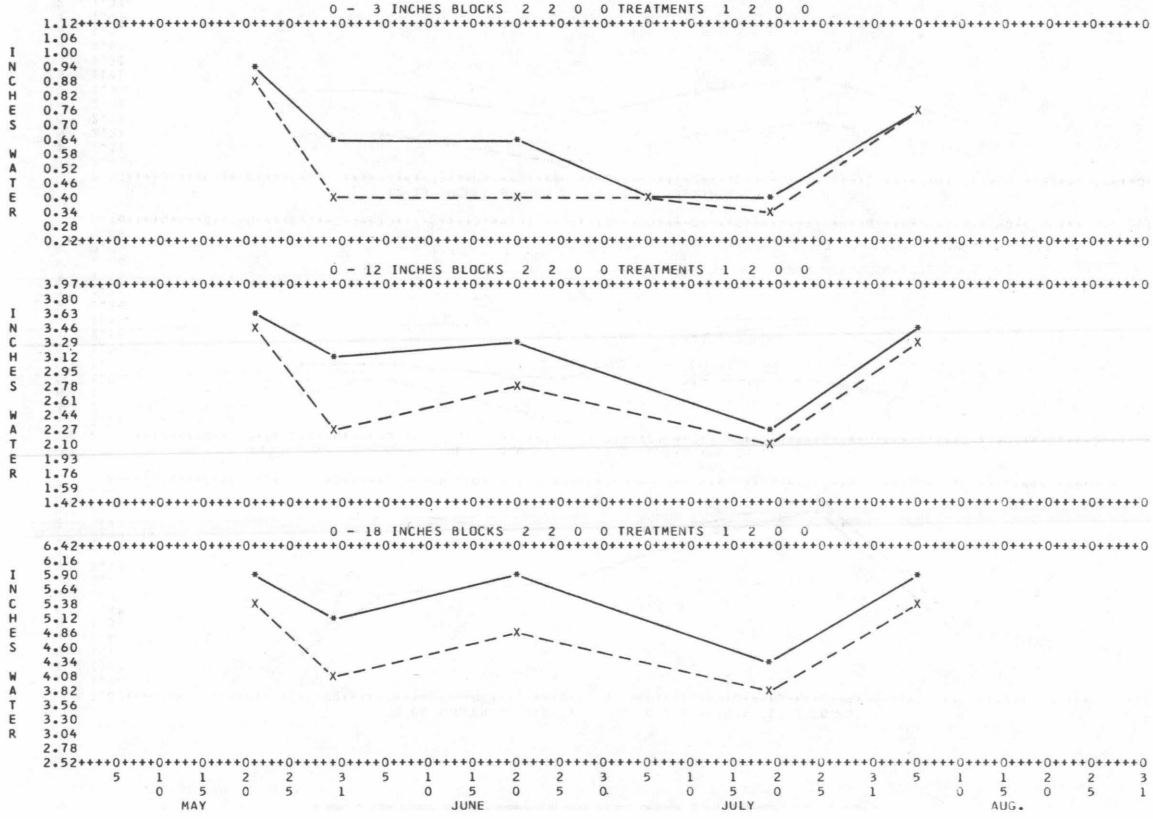


TABLE 15 -- Example Plottings of the Data Given in Table 12 for 2 Combinations (Block 1 - Treatments 1 and 2 and Block 2 - Treatments 1 and 2) at Depths 0"-6", 6"-12" and 12"-18".

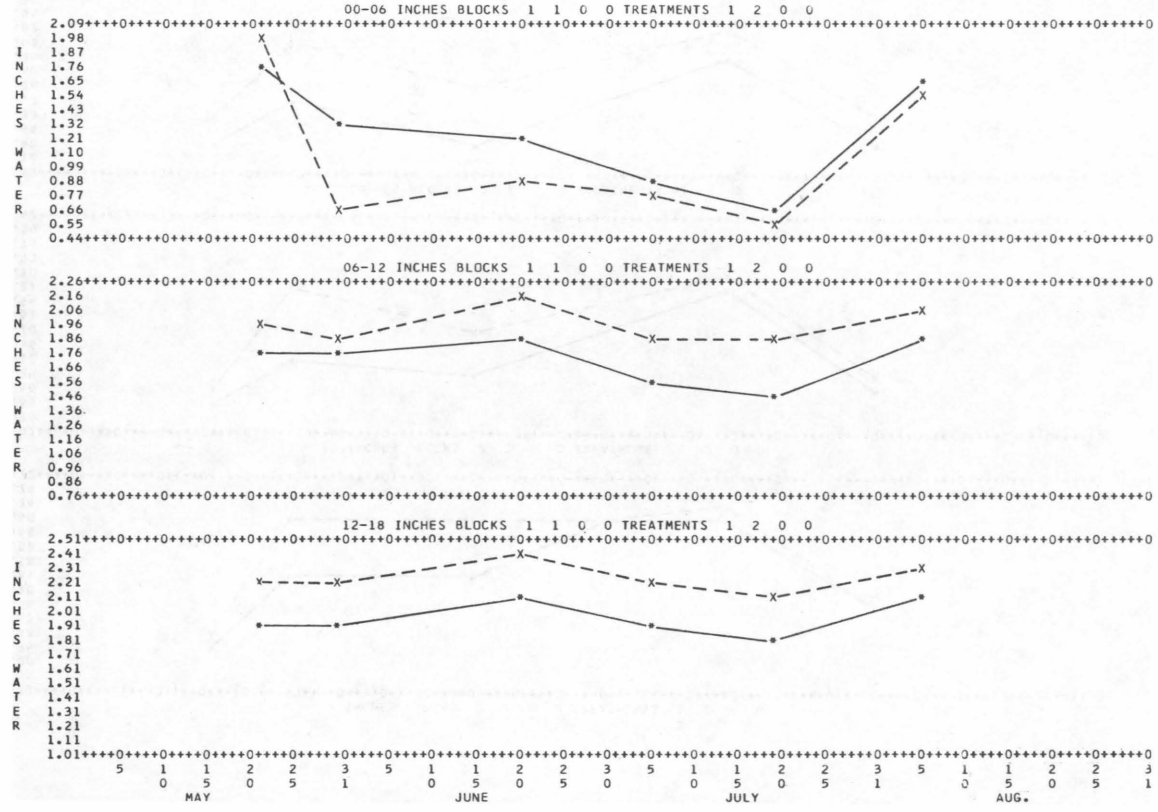


TABLE 15 -- Continued

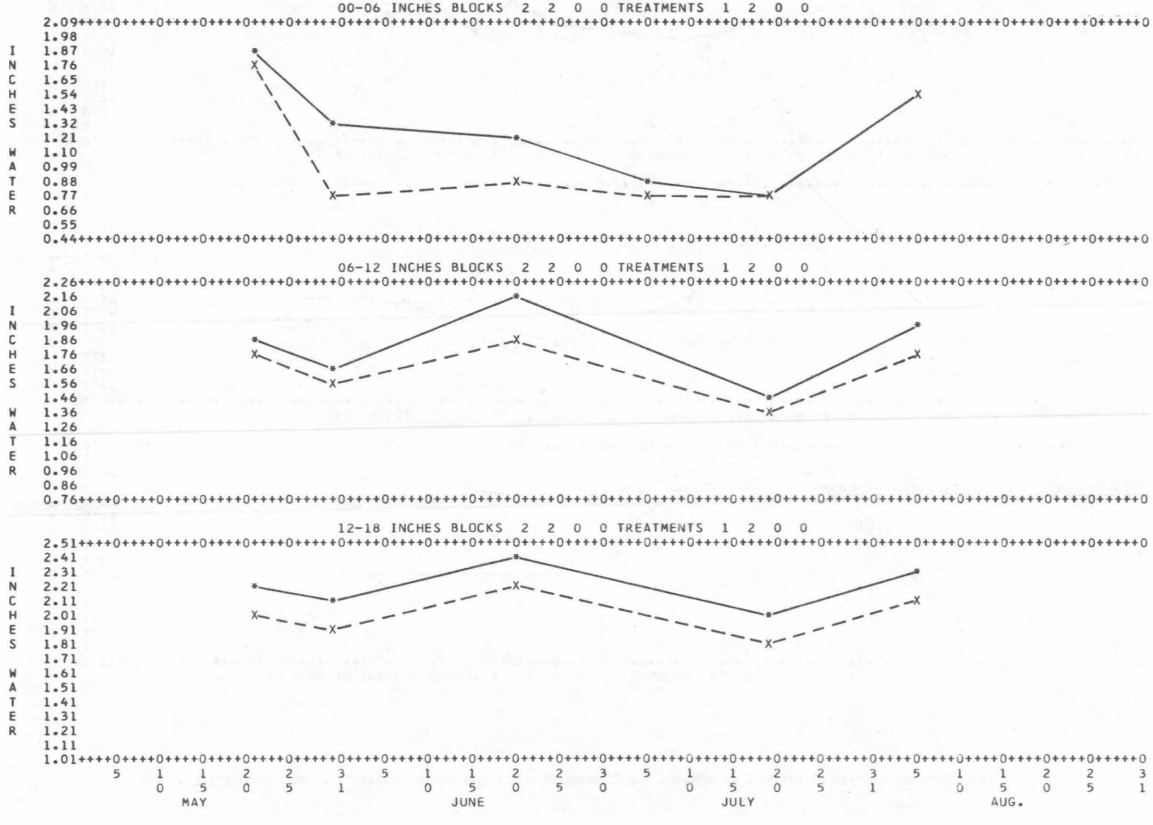


TABLE 16 -- Example Plottings of the Data Given in Table 13 for 3 Groups at 3 Depths (0"-6", 6"-12" and 24"-30").

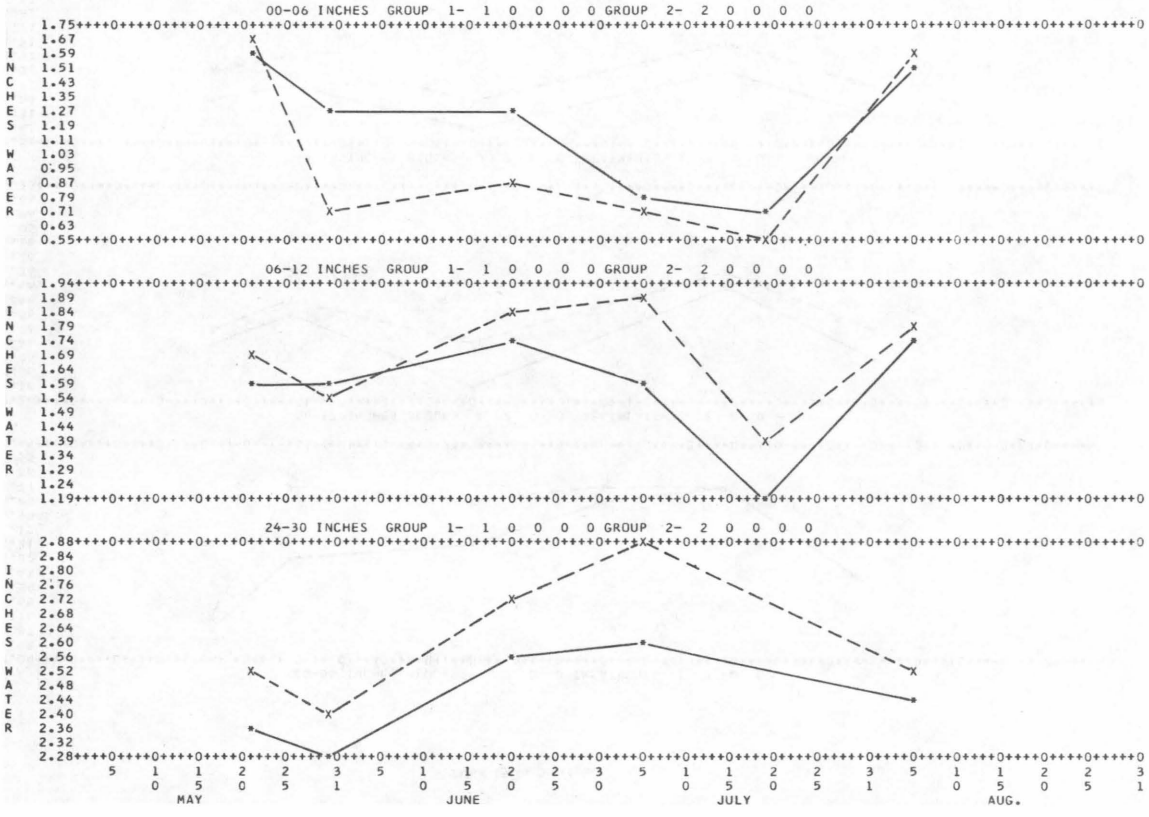


TABLE 16 -- Continued

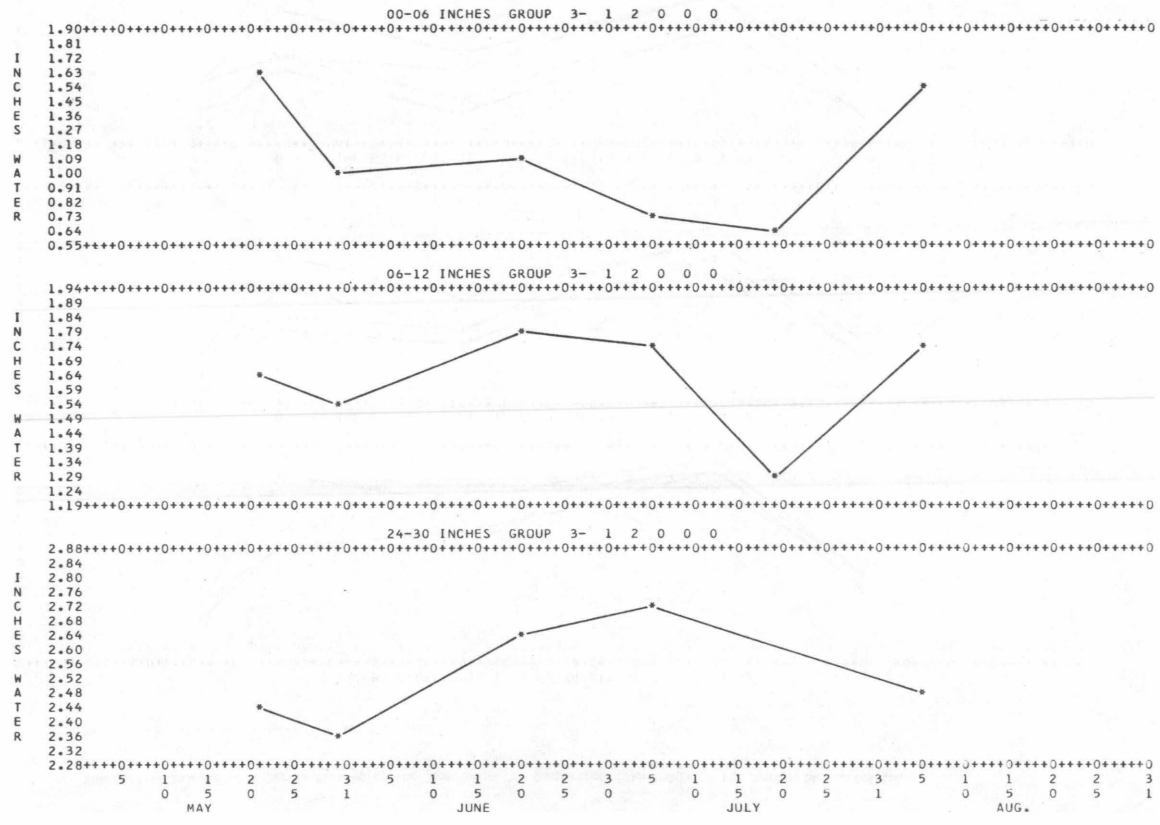


TABLE 17 -- Example of 4 Curves Plotted on the Same Graph for Comparison. See Table 18 for Symbol Identification.

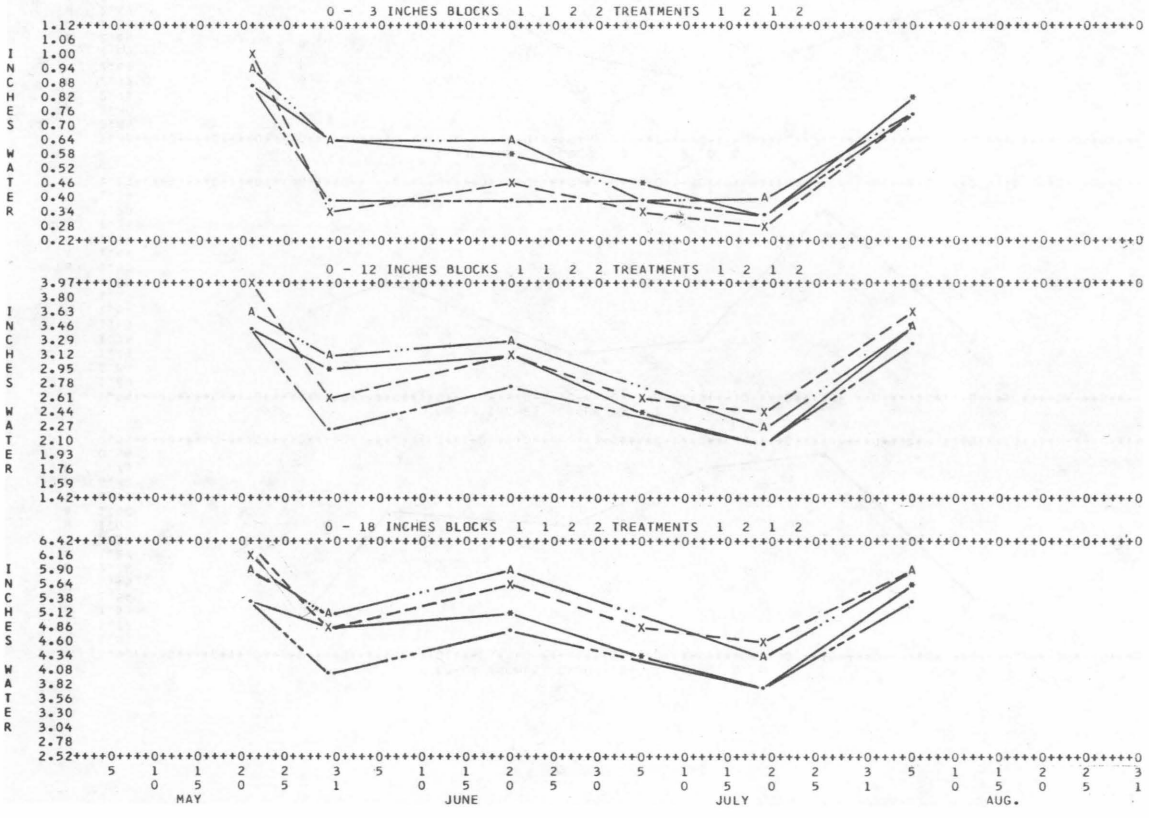


TABLE 18 -- Characters used to Identify Coordinate Points

Curve No.	Character
1	*
2	X
3	A
4	.

When all curves are plotted, they are in the order of 1, 2, 3, and 4, which means that curve No. 4 takes precedence over curve Nos. 1, 2, and 3. Curve No. 3 takes precedence over curve Nos. 1 and 2 and curve No. 2 takes precedence over curve No. 1. For example, if the total soil moisture at the 6" depth happens to be 2.00" for all 4 curves, then the period will be the only character shown on the plotting. Curve Nos. 1, 2, and 3 as well as 4, will go through this one point.

STATISTICAL ANALYSIS

Section 2 was designed so that the output would be applicable for use in Section 3 (Appendix A4). The variables that have been coded for this analysis are blocks, dates, depths, experimental replications, and treatments. Any combination of these variables may be used in the statistical analysis by proper coding. The output cards are coded for efficient sorting by an IBM sorter. Sequential codes for each variable are contained in the following card columns: (a) depths - columns 1-2, (b) treatments - columns 3-4, (c) blocks - columns 5-6, (d) dates - columns 7-8, and (e) experimental replications - columns 9-10. To arrange the data in the correct order as input for Section 3, the data are sorted according to depths, treatments, blocks, dates, and experimental replications.

APPENDIX A

Reduction of Basic Field Moisture and Analysis of Variance for Factorial Design

TABLE A1 -- Code Sheet for Recording Soil Moisture Data

Location BLACKSBURG Sheet 1 of 1

METER	IWD	MO	ND	NYR	NSITE	NTUBE	NDI NO2	COUNTS(1)	COUNTS(2)	COUNTS(3)	COUNTS(4)	COUNTS(5)	KODE	MEMO	NUP	NUM
													7		TIL	1
					BEGAN 0855 DST							PARTLY CLOUDY AND COOL	0			2
3								12124	12316	12163	12365	12584	3			3
					NTT4	1	12IN.	05382	05506				1			4
							18IN.	07894	08074							5
							24IN.	10684	10790							6
							36IN.	11465	11537							7
							48IN.	12851	12721							8
					CTT4		12IN.	04232	04160							9
							18IN.	05987	06113							10
							24IN.	09770	09734							11
							36IN.	12215	12099							12
▼	▼				▼	▼	48IN.	12494	12267	12446			▼		▼	13
							⋮	⋮	⋮							
3	13000	9	1267		CTL1	1	48IN.	12436	12471				1		TIL	83
								12395	12346	12226	11210	4	5			84
4								10813	10633	10677	10537	10765	4			85
4	▼				NTT4		SURFACE	06258	06111				3		▼	86
							⋮	⋮	⋮							
4	13000	9	1267		CTL1		SURFACE	06180	06077				3		TIL	101
								10762	10626				6			102
													7			103
	▼				END TIME 1640 DST								089		▼	104

Values for KODE:

0- No Notes To Follow
1- Depth Probe Reading
2- Surface Reading
3- Depth Standard Reading
4- Surface Standard Reading
5- Check Depth Standard Reading
6- Check Surface Standard Reading
7- Notes To Follow

Notes May Be Written in Columns 13-64

APPENDIX A2 -- Listing of Source Statements for Section 1.

```
$IBFTC MOIST
      DIMENSION DP(304,2),SP(112,2),DPN(304,2)
      DIMENSION NSITE(6),NTUBE(3),ND1ND2(7),NDECS(15),NTEMP(7)
      DIMENSION NSNST(6),NTEBE(3),NCHK(3)
      DIMENSION F610(17),DVLP(2),F620(15),F621(16),F624(16),F625(16)
      DIMENSION STDP(4),STDSP(4)
      DATA NDECS/1H0,1H1,1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9,1HF,1HT,1HI,1HN
     1,1H /
      DATA F610/102H(2I6,I3,I4,1X,6A1,2X,3A1,2X,7A1,
     1          F9.0,F9.1,F11.2,F12.2,4X,A3,I5)     /
      DATA DVLP/12HF7.0 ,1X,A6,/,CHANGE/6H      /
      DATA F620/90H(2I6,I3,I4,7X,14HDEPTH STANDARD,
     1          F9.0,F9.1,27X,A3,I5)     /
      DATA F621/96H(2I6,I3,I4,5X,16HSURFACE STANDARD
     1          F9.0,F9.1,27X,A3,I5)     /
      DATA F624/96H(2I6,I3,I4,21H    CK DEPTH STANDARD ,
     1          F9.0,F9.1,27X,A3,I5)     /
      DATA F625/96H(2I6,I3,I4,21H  CK SURFACE STANDARD ,
     1          F9.0,F9.1,27X,A3,I5)     /
      DATA NCHK/1H.,1H-,1H /
      NCONT=1
      REWIND 1
C
C     LOAD MOISTURE TABLES
C
      NDP=1
  400 JJ=NDP+4
      READ(5,600)(DP(L,1),DP(L,2),L=NDP,JJ),NEND
  600 FORMAT(10F5.1,25X,I1)
      IF(NEND.EQ.9)GO TO 401
      NDP=NDP+5
      GO TO 400
  401 NDPN=1
  402 JJ=NDPN+4
      READ(5,600)(DPN(L,1),DPN(L,2),L=NDPN,JJ),NEND
      IF(NEND.EQ.9)GO TO 403
      NDPN=NDPN+5
      GO TO 402
  403 NSP=1
  404 JJ=NSP+4
      READ(5,600)(SP(L,1),SP(L,2),L=NSP,JJ),NEND
      IF(NEND.EQ.9)GO TO 405
      NSP=NSP+5
      GO TO 404
  405 CONTINUE
    6 LBR=1
      KPAGE=0
      GO TO 90
    5 NUMBER=1
      NEND=0
   25 SUMC=0.0
      ANUM=0.0
      READ(5,605)METER,IWD,MO,ND,NYR,(NSITE(I),I=1,6),(NTUBE(I),I=1,3),(
     1ND1ND2(I),I=1,7),(COUNTS(I),I=1,5),KODE,NEND,NUP
  605 FORMAT(11,I4,3I2,1X,6A1,1X,3A1,7A1,5F5.0,10X,I1,5X,I2,A3)
      IF(KODE.EQ.7)GO TO 220
      IF(KODE.EQ.1)GO TO 8000
 8040 CONTINUE
      DO 30 I=1,5
      IF(COUNTS(I).EQ.0.0)GO TO 30
      SUMC=SUMC+COUNTS(I)
      ANUM=ANUM+1.
   30 CONTINUE
      AVG=SUMC/ANUM
      IF(KODE.GT.2)GO TO 1003
      IF(METER.EQ.3.OR.METER.EQ.4)GO TO 1005
 1003 GO TO(40,75,50,55,200,205),KODE
   40 PCSTD=(AVG/STDP(METER))*100.
 1005 GO TO(301,300,1000,1001),METER
  300 DO 305 I=1,NDPN
      IF(DPN(I,1)-PCSTD)305,365,370
  305 CONTINUE
      I=I-1
  365 PCMOIS=DPN(I,2)
      GO TO 100
  370 J=I-1
      PCMOIS=((PCSTD-DPN(J,1))/(DPN(I,1)-DPN(J,1))*(DPN(I,2)-DPN(J,2)))+
     1DPN(J,2)
      GO TO 100
  301 DO 60 I=1,NDP
      IF(DP(I,1)-PCSTD)60,65,70
   60 CONTINUE
      I=I-1
   65 PCMOIS=DP(I,2)
      GO TO 100
   70 J=I-1
      PCMOIS=((PCSTD-DP(J,1))/(DP(I,1)-DP(J,1))*(DP(I,2)-DP(J,2)))+DP(J,
     12)
  100 CONTINUE
      IF(KODE.EQ.2)GO TO 8000
 8041 CONTINUE
      WRITE(1,610)IWD,MO,ND,NYR,(NSITE(I),I=1,6),(NTEBE(I),I=1,3),(NTEMP
     1(I),I=1,7),(COUNTS(I),I=1,5),SUMC,AVG,PCSTD,PCMOIS,NUP,NCONT
  610 FORMAT(2I6,I3,I4,1X,6A1,2X,3A1,2X,7A1,5F7.0,F9.0,F9.1,F11.2,F12.2,
     18X,A3,I5)
      NCONT=NCONT+1
      NBRANH=1
      LOW=7
      GO TO 899
  912 CONTINUE
      IF(KODE.EQ.1)GO TO 8052
      DO 8051 I=1,7
 8051 NTEMP(I)=ND1ND2(I)
 8052 CONTINUE
      WRITE(6,F610)IWD,MO,ND,NYR,(NSITE(I),I=1,6),(NTUBE(I),I=1,3),(NTEM
     1P(I),I=1,7),(COUNTS(I),I=1,5),SUMC,AVG,PCSTD,PCMOIS,NUP,NUMBER
      NUMBER=NUMBER+1
      LBR=2
      GO TO 88
   75 PCSTD=(AVG/STDSP(METER))*100.
      DO 80 L=1,NSP
      IF(SP(L,1)-PCSTD)80,81,82
   80 CONTINUE
      L=L-1
   81 PCMOIS=SP(L,2)
```

```
      GO TO 199
   82 J=L-1
      PCMOIS=((PCSTD-SP(J,1))/(SP(L,1)-SP(J,1))*(SP(L,2)-SP(J,2)))+SP(J,
     12)
  199 NTEMP(7)=NDECS(14)
      NTEMP(6)=NDECS(13)
      NTEMP(5)=NDECS(1)
      DO 8029 I=1,4
 8029 NTEMP(I)=NDECS(15)
      GO TO 100
   50 STDP(METER)=AVG
      NBRANH=2
      LOW=7
      GO TO 899
  913 CONTINUE
      WRITE(6,F620)IWD,MO,ND,NYR,(COUNTS(I),I=1,5),SUMC,AVG,NUP,NUMBER
      GO TO 54
   55 STDSP(METER)=AVG
      NBRANH=3
      LOW=8
      GO TO 899
  914 CONTINUE
      WRITE(6,F621)IWD,MO,ND,NYR,(COUNTS(I),I=1,5),SUMC,AVG,NUP,NUMBER
   54 NUMBER=NUMBER+1
      LBR=2
   88 IF(LINES.GE.51)GO TO 90
      LINES=LINES+1
      GO TO 95
   90 LINES=0
      KPAGE=KPAGE+1
      WRITE(6,615)KPAGE
  615 FORMAT(1H1120X,4HPAGE,I4/38X,55HSOIL MOISTURE DATA'WATERSHED ENGIN
     1EERING'BLACKSBURG,VA./128HOWSHD NO. MO DAY YR.  SITE  TUBE   DEPTH
     2              COUNTS                        SUM   AVERAGE  PC STANDARD
     3  PC MOISTURE LIST NO.)
      GO TO(5,95),LBR
  200 NBRANH=4
      LOW=8
      GO TO 899
  915 CONTINUE
      WRITE(6,F624)IWD,MO,ND,NYR,(COUNTS(I),I=1,5),SUMC,AVG,NUP,NUMBER
      GO TO 54
  205 NBRANH=5
      LOW=8
      GO TO 899
  916 CONTINUE
      WRITE(6,F625)IWD,MO,ND,NYR,(COUNTS(I),I=1,5),SUMC,AVG,NUP,NUMBER
      GO TO 54
  220 READ(5,630)IWD,MO,ND,NYR,(NOTES(I),I=1,9),KODE,NEND,NUP
  630 FORMAT(1X,I4,3I2,8A6,A5,I1,5X,I2,A3)
      WRITE(6,635)IWD,MO,ND,NYR,(NOTES(I),I=1,9),NUP,NUMBER
  635 FORMAT(2I6,I3,I4,2X,8A6,A5,46X,A3,I5)
      GO TO 54
   95 IF(KODE.EQ.7)GO TO 220
      IF(NEND-9)96,6,99
   96 GO TO(5,25),LBR
   99 REWIND 1
      CALL EXIT
 1000 PCSTD=(AVG/STDP(METER))*100.
      PCMOIS=(PCSTD-7.8)/1.764
      GO TO 100
 1001 PCSTD=(AVG/STDSP(METER))*100.
      PCMOIS=(PCSTD-22.5)/1.60
      GO TO 199
  899 CONTINUE
      LUP=LOW+4
      ICOUNT=0
      DO 900 I=LOW,LUP
      ICOUNT=ICOUNT+1
      IF(COUNTS(ICOUNT).EQ.0.)GO TO 901
      GO TO(902,903,904,905,906),NBRANH
  902 F610(I)=DVLP(1)
      GO TO 900
  903 F620(I)=DVLP(1)
      GO TO 900
  904 F621(I)=DVLP(1)
      GO TO 900
  905 F624(I)=DVLP(1)
      GO TO 900
  906 F625(I)=DVLP(1)
      GO TO 900
  901 COUNTS(ICOUNT)=CHANGE
      GO TO(907,908,909,910,911),NBRANH
  907 F610(I)=DVLP(2)
      GO TO 900
  908 F620(I)=DVLP(2)
      GO TO 900
  909 F621(I)=DVLP(2)
      GO TO 900
  910 F624(I)=DVLP(2)
      GO TO 900
  911 F625(I)=DVLP(2)
  900 CONTINUE
      GO TO(912,913,914,915,916),NBRANH
 8000 CONTINUE
      LK=7
      LM=7
      DO 8005 I=1,6
      LI=LK-I
      NSNST(LI)=NDECS(15)
      IF(NSITE(LI).EQ.NDECS(15))GO TO 8005
      LM=LM-1
      NSNST(LM)=NSITE(LI)
 8005 CONTINUE
      DO 8006 I=1,6
 8006 NSITE(I)=NSNST(I)
      LM=4
      LK=4
      DO 8010 I=1,3
      LI=LK-I
      NTEBE(LI)=NDECS(15)
      DO 8011 J=1,3
```

APPENDIX A2 -- Continued (2)

```
      IF(NTUBE(LI).EQ.NCHK(1).OR.NTUBE(LI).EQ.NCHK(2).OR.NTUBE(LI).EQ.NC
     1HK(3))GO TO 8011
      LM=LM-1
      NTEBE(LM)=NTUBE(LI)
      GO TO 8010
 8011 CONTINUE
 8010 CONTINUE
      IF(KODE.EQ.2)GO TO 8041
      LM=8
      LK=8
      DO 8020 I=1,7
      LI=LK-I
      NTEMP(LI)=NDECS(15)
      DO 8018 J=1,14
      IF(ND1ND2(LI).NE.NDECS(J))GO TO 8018
      LM=LM-1
      NTEMP(LM)=NDECS(J)
 8018 CONTINUE
 8020 CONTINUE
      GO TO 8040
      END
```

TABLE A2a -- Soil Moisture Output Resulting from the Input Data Given in Table C1 Format for Listing by IBM 1401 Only (S.SU06).

SOIL MOISTURE DATA'WATERSHED ENGINEERING'BLACKSBURG,VA.

WSHD NO.	MO	DAY	YR.	SITE	TUBE	DEPTH	COUNTS	SUM	AVERAGE	PC STANDARD	PC MOISTURE	LIST	NO.
1300	9	12	67	BEGAN	0855	DST PARTLY CLOUDY AND COOL						TIL	1
1300	9	12	67	DEPTH	STANDARD	12124. 12316. 12163. 12355. 12584.		61542.	12308.4			TIL	2
1300	9	12	67	NTT4	1	12IN 5382. 5506.		10888.	5444.0	44.23	20.65	TIL	3
1300	9	12	67	NTT4	1	18IN 7894. 8074.		15968.	7984.0	64.87	32.35	TIL	4
1300	9	12	67	NTT4	1	24IN 10684. 10790.		21474.	10737.0	87.23	45.03	TIL	5
1300	9	12	67	NTT4	1	36IN 11465. 11537.		23002.	11501.0	93.44	48.55	TIL	6
1300	9	12	67	NTT4	1	48IN 12851. 12721.		25572.	12786.0	103.88	54.47	TIL	7
1300	9	12	67	CTT4	1	12IN 4232. 4160.		8392.	4196.0	34.09	14.90	TIL	8
1300	9	12	67	CTT4	1	18IN 5987. 6113.		12100.	6050.0	49.15	23.44	TIL	9
1300	9	12	67	CTT4	1	24IN 9770. 9734.		19504.	9752.0	79.23	40.49	TIL	10
1300	9	12	67	CTT4	1	36IN 12215. 12099.		24314.	12157.0	98.77	51.57	TIL	11
1300	9	12	67	CTT4	1	48IN 12494. 12267.	12446.	37207.	12402.3	100.76	52.70	TIL	12
1300	9	12	67	NTL4	1	12IN 5614. 5663.		11277.	5638.5	45.81	21.55	TIL	13
1300	9	12	67	NTL4	1	18IN 6182. 6366.		12548.	6274.0	50.97	24.47	TIL	14
1300	9	12	67	NTL4	1	24IN 7426. 7251.		14677.	7338.5	59.62	29.38	TIL	15
1300	9	12	67	NTL4	1	36IN 10344. 10222.		20566.	10283.0	83.54	42.94	TIL	16
1300	9	12	67	NTL4	1	48IN 13524. 13781.	13677.	40982.	13660.7	110.99	58.50	TIL	17
1300	9	12	67	CTL4	1	12IN 4173. 4070.		8243.	4121.5	33.49	14.56	TIL	18
1300	9	12	67	CTL4	1	18IN 4751. 4625.		9376.	4688.0	38.09	17.17	TIL	19
1300	9	12	67	CTL4	1	24IN 5972. 5879.		11851.	5925.5	48.14	22.87	TIL	20
1300	9	12	67	CTL4	1	36IN 10796. 10867.		21663.	10831.5	88.00	45.47	TIL	21
1300	9	12	67	CTL4	1	48IN 13078. 12971.		26049.	13024.5	105.82	55.57	TIL	22
1300	9	12	67	NTL3	1	12IN 5420. 5283.		10703.	5351.5	43.48	20.23	TIL	23
1300	9	12	67	NTL3	1	18IN 7957. 7839.		15796.	7898.0	64.17	31.95	TIL	24
1300	9	12	67	NTL3	1	24IN 10240. 10209.		20449.	10224.5	83.07	42.67	TIL	25
1300	9	12	67	NTL3	1	36IN 12069. 11830.	12004.	35903.	11967.7	97.23	50.70	TIL	26
1300	9	12	67	NTL3	1	48IN 13597. 13607.		27204.	13602.0	110.51	58.23	TIL	27
1300	9	12	67	CTL3	1	12IN 7267. 7444.		14711.	7355.5	59.76	29.46	TIL	28
1300	9	12	67	CTL3	1	18IN 9802. 9874.		19676.	9838.0	79.93	40.89	TIL	29
1300	9	12	67	CTL3	1	24IN 10792. 10786.		21578.	10789.0	87.66	45.27	TIL	30
1300	9	12	67	CTL3	1	36IN 11247. 11401.		22648.	11324.0	92.00	47.73	TIL	31
1300	9	12	67	CTL3	1	48IN 13170. 13344.		26514.	13257.0	107.71	56.64	TIL	32
1300	9	12	67	NTT3	1	12IN 4389. 4320.		8709.	4354.5	35.38	15.63	TIL	33
1300	9	12	67	NTT3	1	18IN 4905. 4673.	4947.	14525.	4841.7	39.34	17.88	TIL	34
1300	9	12	67	NTT3	1	24IN 7083. 7128.		14211.	7105.5	57.73	28.30	TIL	35
1300	9	12	67	NTT3	1	36IN 11990. 11970.		23960.	11980.0	97.33	50.76	TIL	36
1300	9	12	67	NTT3	1	48IN 13164. 13165.		26329.	13164.5	106.96	56.21	TIL	37
1300	9	12	67	CTT3	1	12IN 6197. 6004.		12201.	6100.5	49.56	23.68	TIL	38
1300	9	12	67	CTT3	1	18IN 9576. 9333.	9423.	28332.	9444.0	76.73	39.07	TIL	39
1300	9	12	67	CTT3	1	24IN 10811. 10955.		21766.	10883.0	88.42	45.70	TIL	40
1300	9	12	67	CTT3	1	36IN 12684. 12600.		25284.	12642.0	102.71	53.80	TIL	41
1300	9	12	67	CTT3	1	48IN 12072. 12187.		24259.	12129.5	98.55	51.44	TIL	42
1300	9	12	67	NTL2	1	12IN 7795. 7806.		15601.	7800.5	63.38	31.51	TIL	43
1300	9	12	67	NTL2	1	18IN 10604. 10417.		21021.	10510.5	85.39	43.99	TIL	44
1300	9	12	67	NTL2	1	24IN 11588. 11581.		23169.	11584.5	94.12	48.93	TIL	45
1300	9	12	67	NTL2	1	36IN 12648. 12894.	12761.	38303.	12767.7	103.73	54.38	TIL	46
1300	9	12	67	NTL2	1	48IN 11520. 11577.		23097.	11548.5	93.83	48.77	TIL	47
1300	9	12	67	CTL2	1	12IN 7925. 7942.		15867.	7933.5	64.46	32.12	TIL	48
1300	9	12	67	CTL2	1	18IN 9450. 9618.		19068.	9534.0	77.46	39.49	TIL	49
1300	9	12	67	CTL2	1	24IN 10462. 10350.		20812.	10406.0	84.54	43.51	TIL	50
1300	9	12	67	CTL2	1	36IN 10306. 10330.		20636.	10318.0	83.83	43.10	TIL	51
1300	9	12	67	CTL2	1	48IN 10938. 11134.		22072.	11036.0	89.66	46.41	TIL	52

TABLE A2a -- Continued

SOIL MOISTURE DATA'WATERSHED ENGINEERING'BLACKSBURG,VA.

WSHD NO.	MO	DAY	YR.	SITE	TUBE	DEPTH	COUNTS	SUM	AVERAGE	PC STANDARD	PC MOISTURE	LIST NO.
1300	9	12	67	NTT2	1	12IN	6638. 6662.	13300.	6650.0	54.03	26.21	TIL 53
1300	9	12	67	NTT2	1	18IN	9919. 9788.	19707.	9853.5	80.06	40.96	TIL 54
1300	9	12	67	NTT2	1	24IN	11197. 11227.	22424.	11212.0	91.09	47.22	TIL 55
1300	9	12	67	NTT2	1	36IN	11611. 11768.	23379.	11689.5	94.97	49.42	TIL 56
1300	9	12	67	NTT2	1	48IN	11787. 11825.	23612.	11806.0	95.92	49.95	TIL 57
1300	9	12	67	CTT2	1	12IN	5986. 5934.	11920.	5960.0	48.42	23.03	TIL 58
1300	9	12	67	CTT2	1	18IN	4989. 5037.	10026.	5013.0	40.73	18.67	TIL 59
1300	9	12	67	CTT2	1	24IN	5267. 5127.	10394.	5197.0	42.22	19.51	TIL 60
1300	9	12	67	CTT2	1	36IN	6848. 6831.	13679.	6839.5	55.57	27.08	TIL 61
1300	9	12	67	CTT2	1	48IN	6901. 6935.	13836.	6918.0	56.21	27.44	TIL 62
1300	9	12	67	NTT1	1	12IN	5716. 5694.	11410.	5705.0	46.35	21.85	TIL 63
1300	9	12	67	NTT1	1	18IN	7230. 7127.	14357.	7178.5	58.32	28.64	TIL 64
1300	9	12	67	NTT1	1	24IN	10207. 10367.	20574.	10287.0	83.58	42.96	TIL 65
1300	9	12	67	NTT1	1	36IN	11806. 11902.	23708.	11854.0	96.31	50.17	TIL 66
1300	9	12	67	NTT1	1	48IN	12462. 12759. 12588.	37809.	12603.0	102.39	53.62	TIL 67
1300	9	12	67	CTT1	1	12IN	7023. 7064.	14087.	7043.5	57.23	28.02	TIL 68
1300	9	12	67	CTT1	1	18IN	10449. 10540.	20989.	10494.5	85.26	43.91	TIL 69
1300	9	12	67	CTT1	1	24IN	11496. 11464.	22960.	11480.0	93.27	48.45	TIL 70
1300	9	12	67	CTT1	1	36IN	11248. 11227.	22475.	11237.5	91.30	47.34	TIL 71
1300	9	12	67	CTT1	1	48IN	11803. 11810.	23613.	11806.5	95.92	49.96	TIL 72
1300	9	12	67	NTL1	1	12IN	5202. 5234.	10436.	5218.0	42.39	19.61	TIL 73
1300	9	12	67	NTL1	1	18IN	7432. 7475.	14907.	7453.5	60.56	29.91	TIL 74
1300	9	12	67	NTL1	1	24IN	10085. 10131.	20216.	10108.0	82.12	42.13	TIL 75
1300	9	12	67	NTL1	1	36IN	11564. 11617.	23181.	11590.5	94.17	48.96	TIL 76
1300	9	12	67	NTL1	1	48IN	12233. 12260.	24493.	12246.5	99.50	51.98	TIL 77
1300	9	12	67	CTL1	1	12IN	7472. 7655.	15127.	7563.5	61.45	30.41	TIL 78
1300	9	12	67	CTL1	1	18IN	10499. 10451.	20950.	10475.0	85.10	43.82	TIL 79
1300	9	12	67	CTL1	1	24IN	11892. 11722.	23614.	11807.0	95.93	49.96	TIL 80
1300	9	12	67	CTL1	1	36IN	13003. 13193.	26196.	13098.0	106.42	55.90	TIL 81
1300	9	12	67	CTL1	1	48IN	12436. 12471.	24907.	12453.5	101.18	52.94	TIL 82
1300	9	12	67	CK DEPTH STANDARD			12395. 12346. 12261. 12104.	49106.	12276.5			TIL 83
1300	9	12	67	SURFACE STANDARD			10813. 10633. 10677. 10537. 10765.	53425.	10685.0			TIL 84
1300	9	12	67	NTT4		SURFACE	6258. 6111.	12369.	6184.5	57.88	22.11	TIL 85
1300	9	12	67	CTT4		SURFACE	5564. 5460.	11024.	5512.0	51.59	18.18	TIL 86
1300	9	12	67	NTL4		SURFACE	5612. 5826. 5669.	17107.	5702.3	53.37	19.29	TIL 87
1300	9	12	67	CTL4		SURFACE	5323. 5295.	10618.	5309.0	49.69	16.99	TIL 88
1300	9	12	67	NTL3		SURFACE	5880. 5726.	11606.	5803.0	54.31	19.88	TIL 89
1300	9	12	67	CTL3		SURFACE	5966. 5914.	11880.	5940.0	55.59	20.68	TIL 90
1300	9	12	67	NTT3		SURFACE	6032. 6080.	12112.	6056.0	56.68	21.36	TIL 91
1300	9	12	67	CTT3		SURFACE	5734. 5872.	11606.	5803.0	54.31	19.88	TIL 92
1300	9	12	67	NTL2		SURFACE	5945. 6066.	12011.	6005.5	56.20	21.07	TIL 93
1300	9	12	67	CTL2		SURFACE	6292. 6405.	12697.	6348.5	59.42	23.07	TIL 94
1300	9	12	67	NTT2		SURFACE	6334. 6417.	12751.	6375.5	59.67	23.23	TIL 95
1300	9	12	67	CTT2		SURFACE	5874. 5880.	11754.	5877.0	55.00	20.31	TIL 96
1300	9	12	67	NTT1		SURFACE	5926. 5925.	11851.	5925.5	55.46	20.60	TIL 97
1300	9	12	67	CTT1		SURFACE	6001. 5848.	11849.	5924.5	55.45	20.59	TIL 98
1300	9	12	67	NTL1		SURFACE	5770. 5708.	11478.	5739.0	53.71	19.51	TIL 99
1300	9	12	67	CTL1		SURFACE	6180. 6077.	12257.	6128.5	57.36	21.79	TIL 100
1300	9	12	67	CK SURFACE STANDARD			10762. 10626.	21388.	10694.0			TIL 101
1300	9	12	67	END TIME 1640 DST								TIL 102

TABLE A2b -- Soil Moisture Output Resulting from the Input Data Given in Table C1 Format for Permanent Storage (S.SUQO).

1300	9	12	67	NTT4	1	12IN	5382.	5506.	-0.	-0.	-0.	10888.	5444.0	44.23	20.65	TIL	1
1300	9	12	67	NTT4	1	18IN	7894.	8074.	-0.	-0.	-0.	15968.	7984.0	64.87	32.35	TIL	2
1300	9	12	67	NTT4	1	24IN	10684.	10790.	-0.	-0.	-0.	21474.	10737.0	87.23	45.03	TIL	3
1300	9	12	67	NTT4	1	36IN	11465.	11537.	-0.	-0.	-0.	23002.	11501.0	93.44	48.55	TIL	4
1300	9	12	67	NTT4	1	48IN	12851.	12721.	-0.	-0.	-0.	25572.	12786.0	103.88	54.47	TIL	5
1300	9	12	67	CTT4	1	12IN	4232.	4160.	-0.	-0.	-0.	8392.	4196.0	34.09	14.90	TIL	6
1300	9	12	67	CTT4	1	18IN	5987.	6113.	-0.	-0.	-0.	12100.	6050.0	49.15	23.44	TIL	7
1300	9	12	67	CTT4	1	24IN	9770.	9734.	-0.	-0.	-0.	19504.	9752.0	79.23	40.49	TIL	8
1300	9	12	67	CTT4	1	36IN	12215.	12099.	-0.	-0.	-0.	24314.	12157.0	98.77	51.57	TIL	9
1300	9	12	67	CTT4	1	48IN	12494.	12267.	12446.	-0.	-0.	37207.	12402.3	100.76	52.70	TIL	10
1300	9	12	67	NTL4	1	12IN	5614.	5663.	-0.	-0.	-0.	11277.	5638.5	45.81	21.55	TIL	11
1300	9	12	67	NTL4	1	18IN	6182.	6366.	-0.	-0.	-0.	12548.	6274.0	50.97	24.47	TIL	12
1300	9	12	67	NTL4	1	24IN	7426.	7251.	-0.	-0.	-0.	14677.	7338.5	59.62	29.38	TIL	13
1300	9	12	67	NTL4	1	36IN	10344.	10222.	-0.	-0.	-0.	20566.	10283.0	83.54	42.94	TIL	14
1300	9	12	67	NTL4	1	48IN	13524.	13781.	13677.	-0.	-0.	40982.	13660.7	110.99	58.50	TIL	15
1300	9	12	67	CTL4	1	12IN	4173.	4070.	-0.	-0.	-0.	8243.	4121.5	33.49	14.56	TIL	16
1300	9	12	67	CTL4	1	18IN	4751.	4625.	-0.	-0.	-0.	9376.	4688.0	38.09	17.17	TIL	17
1300	9	12	67	CTL4	1	24IN	5972.	5879.	-0.	-0.	-0.	11851.	5925.5	48.14	22.87	TIL	18
1300	9	12	67	CTL4	1	36IN	10796.	10867.	-0.	-0.	-0.	21663.	10831.5	88.00	45.47	TIL	19
1300	9	12	67	CTL4	1	48IN	13078.	12971.	-0.	-0.	-0.	26049.	13024.5	105.82	55.57	TIL	20
1300	9	12	67	NTL3	1	12IN	5420.	5283.	-0.	-0.	-0.	10703.	5351.5	43.48	20.23	TIL	21
1300	9	12	67	NTL3	1	18IN	7957.	7839.	-0.	-0.	-0.	15796.	7898.0	64.17	31.95	TIL	22
1300	9	12	67	NTL3	1	24IN	10240.	10209.	-0.	-0.	-0.	20449.	10224.5	83.07	42.67	TIL	23
1300	9	12	67	NTL3	1	36IN	12069.	11830.	12004.	-0.	-0.	35903.	11967.7	97.23	50.70	TIL	24
1300	9	12	67	NTL3	1	48IN	13597.	13607.	-0.	-0.	-0.	27204.	13602.0	110.51	58.23	TIL	25
1300	9	12	67	CTL3	1	12IN	7267.	7444.	-0.	-0.	-0.	14711.	7355.5	59.76	29.46	TIL	26
1300	9	12	67	CTL3	1	18IN	9802.	9874.	-0.	-0.	-0.	19676.	9838.0	79.93	40.89	TIL	27
1300	9	12	67	CTL3	1	24IN	10792.	10786.	-0.	-0.	-0.	21578.	10789.0	87.66	45.27	TIL	28
1300	9	12	67	CTL3	1	36IN	11247.	11401.	-0.	-0.	-0.	22648.	11324.0	92.00	47.73	TIL	29
1300	9	12	67	CTL3	1	48IN	13170.	13344.	-0.	-0.	-0.	26514.	13257.0	107.71	56.64	TIL	30
1300	9	12	67	NTT3	1	12IN	4389.	4320.	-0.	-0.	-0.	8709.	4354.5	35.38	15.63	TIL	31
1300	9	12	67	NTT3	1	18IN	4905.	4673.	4947.	-0.	-0.	14525.	4841.7	39.34	17.88	TIL	32
1300	9	12	67	NTT3	1	24IN	7083.	7128.	-0.	-0.	-0.	14211.	7105.5	57.73	28.30	TIL	33
1300	9	12	67	NTT3	1	36IN	11990.	11970.	-0.	-0.	-0.	23960.	11980.0	97.33	50.76	TIL	34
1300	9	12	67	NTT3	1	48IN	13164.	13165.	-0.	-0.	-0.	26329.	13164.5	106.96	56.21	TIL	35
1300	9	12	67	CTT3	1	12IN	6197.	6004.	-0.	-0.	-0.	12201.	6100.5	49.56	23.68	TIL	36
1300	9	12	67	CTT3	1	18IN	9576.	9333.	9423.	-0.	-0.	28332.	9444.0	76.73	39.07	TIL	37
1300	9	12	67	CTT3	1	24IN	10811.	10955.	-0.	-0.	-0.	21766.	10883.0	88.42	45.70	TIL	38
1300	9	12	67	CTT3	1	36IN	12684.	12600.	-0.	-0.	-0.	25284.	12642.0	102.71	53.80	TIL	39
1300	9	12	67	CTT3	1	48IN	12072.	12187.	-0.	-0.	-0.	24259.	12129.5	98.55	51.44	TIL	40
1300	9	12	67	NTL2	1	12IN	7795.	7806.	-0.	-0.	-0.	15601.	7800.5	63.38	31.51	TIL	41
1300	9	12	67	NTL2	1	18IN	10604.	10417.	-0.	-0.	-0.	21021.	10510.5	85.39	43.99	TIL	42
1300	9	12	67	NTL2	1	24IN	11588.	11581.	-0.	-0.	-0.	23169.	11584.5	94.12	48.93	TIL	43
1300	9	12	67	NTL2	1	36IN	12648.	12894.	12761.	-0.	-0.	38303.	12767.7	103.73	54.38	TIL	44
1300	9	12	67	NTL2	1	48IN	11520.	11577.	-0.	-0.	-0.	23097.	11548.5	93.83	48.77	TIL	45
1300	9	12	67	CTL2	1	12IN	7925.	7942.	-0.	-0.	-0.	15867.	7933.5	64.46	32.12	TIL	46
1300	9	12	67	CTL2	1	18IN	9450.	9618.	-0.	-0.	-0.	19068.	9534.0	77.46	39.49	TIL	47
1300	9	12	67	CTL2	1	24IN	10462.	10350.	-0.	-0.	-0.	20812.	10406.0	84.54	43.51	TIL	48
1300	9	12	67	CTL2	1	36IN	10306.	10330.	-0.	-0.	-0.	20636.	10318.0	83.83	43.10	TIL	49

TABLE A2b -- Continued

1300	9	12	67	CTL2	1	48IN	10938.	11134.	-0.	-0.	-0.	22072.	11036.0	89.66	46.41	TIL	50
1300	9	12	67	NTT2	1	12IN	6638.	6662.	-0.	-0.	-0.	13300.	6650.0	54.03	26.21	TIL	51
1300	9	12	67	NTT2	1	18IN	9919.	9788.	-0.	-0.	-0.	19707.	9853.5	80.06	40.96	TIL	52
1300	9	12	67	NTT2	1	24IN	11197.	11227.	-0.	-0.	-0.	22424.	11212.0	91.09	47.22	TIL	53
1300	9	12	67	NTT2	1	36IN	11611.	11768.	-0.	-0.	-0.	23379.	11689.5	94.97	49.42	TIL	54
1300	9	12	67	NTT2	1	48IN	11787.	11825.	-0.	-0.	-0.	23612.	11806.0	95.92	49.95	TIL	55
1300	9	12	67	CTT2	1	12IN	5986.	5934.	-0.	-0.	-0.	11920.	5960.0	48.42	23.03	TIL	56
1300	9	12	67	CTT2	1	18IN	4989.	5037.	-0.	-0.	-0.	10026.	5013.0	40.73	18.67	TIL	57
1300	9	12	67	CTT2	1	24IN	5267.	5127.	-0.	-0.	-0.	10394.	5197.0	42.22	19.51	TIL	58
1300	9	12	67	CTT2	1	36IN	6848.	6831.	-0.	-0.	-0.	13679.	6839.5	55.57	27.08	TIL	59
1300	9	12	67	CTT2	1	48IN	6901.	6935.	-0.	-0.	-0.	13836.	6918.0	56.21	27.44	TIL	60
1300	9	12	67	NTT1	1	12IN	5716.	5694.	-0.	-0.	-0.	11410.	5705.0	46.35	21.85	TIL	61
1300	9	12	67	NTT1	1	18IN	7230.	7127.	-0.	-0.	-0.	14357.	7178.5	58.32	28.64	TIL	62
1300	9	12	67	NTT1	1	24IN	10207.	10367.	-0.	-0.	-0.	20574.	10287.0	83.58	42.96	TIL	63
1300	9	12	67	NTT1	1	36IN	11806.	11902.	-0.	-0.	-0.	23708.	11854.0	96.31	50.17	TIL	64
1300	9	12	67	NTT1	1	48IN	12462.	12759.	12588.	-0.	-0.	37809.	12603.0	102.39	53.62	TIL	65
1300	9	12	67	CTT1	1	12IN	7023.	7064.	-0.	-0.	-0.	14087.	7043.5	57.23	28.02	TIL	66
1300	9	12	67	CTT1	1	18IN	10449.	10540.	-0.	-0.	-0.	20989.	10494.5	85.26	43.91	TIL	67
1300	9	12	67	CTT1	1	24IN	11496.	11464.	-0.	-0.	-0.	22960.	11480.0	93.27	48.45	TIL	68
1300	9	12	67	CTT1	1	36IN	11248.	11227.	-0.	-0.	-0.	22475.	11237.5	91.30	47.34	TIL	69
1300	9	12	67	CTT1	1	48IN	11803.	11810.	-0.	-0.	-0.	23613.	11806.5	95.92	49.96	TIL	70
1300	9	12	67	NTL1	1	12IN	5202.	5234.	-0.	-0.	-0.	10436.	5218.0	42.39	19.61	TIL	71
1300	9	12	67	NTL1	1	18IN	7432.	7475.	-0.	-0.	-0.	14907.	7453.5	60.56	29.91	TIL	72
1300	9	12	67	NTL1	1	24IN	10085.	10131.	-0.	-0.	-0.	20216.	10108.0	82.12	42.13	TIL	73
1300	9	12	67	NTL1	1	36IN	11564.	11617.	-0.	-0.	-0.	23181.	11590.5	94.17	48.96	TIL	74
1300	9	12	67	NTL1	1	48IN	12233.	12260.	-0.	-0.	-0.	24493.	12246.5	99.50	51.98	TIL	75
1300	9	12	67	CTL1	1	12IN	7472.	7655.	-0.	-0.	-0.	15127.	7563.5	61.45	30.41	TIL	76
1300	9	12	67	CTL1	1	18IN	10499.	10451.	-0.	-0.	-0.	20950.	10475.0	85.10	43.82	TIL	77
1300	9	12	67	CTL1	1	24IN	11892.	11722.	-0.	-0.	-0.	23614.	11807.0	95.93	49.96	TIL	78
1300	9	12	67	CTL1	1	36IN	13003.	13193.	-0.	-0.	-0.	26196.	13098.0	106.42	55.90	TIL	79
1300	9	12	67	CTL1	1	48IN	12436.	12471.	-0.	-0.	-0.	24907.	12453.5	101.18	52.94	TIL	80
1300	9	12	67	NTT4		0IN	6258.	6111.	-0.	-0.	-0.	12369.	6184.5	57.88	22.11	TIL	81
1300	9	12	67	CTT4		0IN	5564.	5460.	-0.	-0.	-0.	11024.	5512.0	51.59	18.18	TIL	82
1300	9	12	67	NTL4		0IN	5612.	5826.	5669.	-0.	-0.	17107.	5702.3	53.37	19.29	TIL	83
1300	9	12	67	CTL4		0IN	5323.	5295.	-0.	-0.	-0.	10618.	5309.0	49.69	16.99	TIL	84
1300	9	12	67	NTL3		0IN	5880.	5726.	-0.	-0.	-0.	11606.	5803.0	54.31	19.88	TIL	85
1300	9	12	67	CTL3		0IN	5966.	5914.	-0.	-0.	-0.	11880.	5940.0	55.59	20.68	TIL	86
1300	9	12	67	NTT3		0IN	6032.	6080.	-0.	-0.	-0.	12112.	6056.0	56.68	21.36	TIL	87
1300	9	12	67	CTT3		0IN	5734.	5872.	-0.	-0.	-0.	11606.	5803.0	54.31	19.88	TIL	88
1300	9	12	67	NTL2		0IN	5945.	6066.	-0.	-0.	-0.	12011.	6005.5	56.20	21.07	TIL	89
1300	9	12	67	CTL2		0IN	6292.	6405.	-0.	-0.	-0.	12697.	6348.5	59.42	23.07	TIL	90
1300	9	12	67	NTT2		0IN	6334.	6417.	-0.	-0.	-0.	12751.	6375.5	59.67	23.23	TIL	91
1300	9	12	67	CTT2		0IN	5874.	5880.	-0.	-0.	-0.	11754.	5877.0	55.00	20.31	TIL	92
1300	9	12	67	NTT1		0IN	5926.	5925.	-0.	-0.	-0.	11851.	5925.5	55.46	20.60	TIL	93
1300	9	12	67	CTT1		0IN	6001.	5848.	-0.	-0.	-0.	11849.	5924.5	55.45	20.59	TIL	94
1300	9	12	67	NTL1		0IN	5770.	5708.	-0.	-0.	-0.	11478.	5739.0	53.71	19.51	TIL	95
1300	9	12	67	CTL1		0IN	6180.	6077.	-0.	-0.	-0.	12257.	6128.5	57.36	21.79	TIL	96

APPENDIX A1 -- Reduction of Basic Field Moisture Data

SECTION 1

The information contained in Appendixes A1, A2 and A3 was abstracted from an ARS 41 publication by Shanholtz and Burford. [1/] Section 1 was designed to reduce basic field moisture data in its most general form to percentage moisture by volume when the counting rate, percentage standard and calibration are known.

Input

The input consists of:

1. Three tables containing coordinate points for 2 depth probes and 1 surface probe.
2. Basic soil moisture data.

Tables

Percentage moisture by volume is obtained from calibration curves that relate counts as a percentage standard to known moisture contents. Given a specific value for the percentage of standard, then the percentage moisture by volume may be determined from either a calibration table or an algebraic equation of the relationship between percentage standard and percentage moisture content. The use of calibration tables has the advantage of versatility, especially if several different types of instruments are being used, each of which has a different calibration curve.

Three depth moisture probes and 2 surface moisture probes are available for use at the Blacksburg, Va., research station. These probes will be referred to hereafter as depth probe 1, 2, or 3, and surface probe 1 or 2. Each probe has a unique calibration curve. Calibration tables have been developed for depth probes 1 and 2, and surface probe 1. Two linear equations of the form $y = a + bx$ were found to adequately define the calibration curves for depth probe 3 and surface probe 2.

[1/] Shanholtz, V. O. and J. B. Burford, "Computer Systems for Reduction and Analysis of Hydrologic data," ARS 41-132, 90 pps, July 1967.

The program has been designed so that data collected from 5 instruments may be processed concurrently. The only requirement is that the data must be coded to agree with the loading order of the calibration tables (see METER, appendix list A3). The order of loading of the calibration tables must always be depth probe 1, 2, and surface probe 1. The selection of which probe is to be 1 or 2 is arbitrary. The calibration curves defined by algebraic equations are fixed and can only be changed by reprogramming the particular statements in question.

The formats for the three calibration tables are identical and the information contained in each table is illustrated below. Each card contains 10 five-digit data fields. The last card of each table must contain a nine in column 76. Decimal points must always be punched.

1-5	6-10	11-15	16-20	21-25	26-30
XXX.X	XX.X	XXX.X	XXX.X	XXX.X	XXX.X
DP(L,1)	DP(L,2)	DP(L+1,1)	DP(L+1,2)	DP(L+2,1)	DP(L+2,2)
DPN(L,1)	DPN(L,2)	DPN(L+1,1)	DPN(L+1,2)	DPN(L+2,1)	DPN(L+2,2)
SP(L,1)	SP(L,2)	SP(L+1,1)	SP(L+1,2)	SP(L+2,1)	SP(L+2,2)

31-35	36-40	41-45	46-50	51-75	76
XXX.X	XXX.X	XXX.X	XXX.X		X
DP(L+3,1)	DP(L+3,2)	DP(L+4,1)	DP(L+4,2)	Table	NEND
DPN(L+3,1)	DPN(L+3,2)	DPN(L+4,1)	DPN(L+4,2)	Identifi-	
SP(L+3,1)	SP(L+3,2)	SP(L+4,1)	SP(L+4,2)	cation	

Basic Data

The information contained in the basic data card is illustrated below. The variable names are described in appendix list A2.

1	2-5	6-7	8-9	10-11	13-18	19-22	23-29
X	XXXX	XX	XX	XX	XXXXXX	XXXX	XXXXXXX
METER	IWD	MO	ND	NYR	NSITE(I)	NTUBE(I)	NDIND2(I)

30-34	35-39	40-44	45-49	50-54
XXXXX.	XXXXX.	XXXXX.	XXXXX.	XXXXX.
COUNTS(I)	COUNTS(I+1)	COUNTS(I+2)	COUNTS(I+3)	COUNTS(I+4)

65	71-72	73-75
X	XX	XXX
KODE	NEND	NUP

Order of Input

The input data must be loaded as follows:

1. Cards required by computer residence.
2. Object program.
3. Tables.
4. Basic data.
5. Repeat step 4 for additional groups of soil moisture data.

Data Preparation

Table A1 has been designed to serve as both a field note sheet and program code sheet. The readings are placed in their appropriate columns as they are being taken. This procedure eliminates unnecessary effort in preparing the data for card punching. The following coding must be adhered to:

1. METER equals 1 when using depth probe 1, 2 when using depth probe 2, 3 when using depth probe 3, and 4 when using surface probe 2. The calibration curves are also loaded in this order.

2. KODE must be one of the integers listed at the bottom of the code sheet (Table A1).

3. When recording notes, the procedure is as follows: Place a 7 in column 65, skip to the next line and record notes in columns 13-64. If additional lines are needed, place a 7 in column 65 and continue to record notes. Column 65 will be black for the last line of notes for any particular series of notes.

4. Place a 9 in column 72 of the last data card for intermediate station records. The last soil moisture data card must also contain a 9 in column 71 so that soil moisture processing will be terminated.

The data given in Table A1 illustrate the above coding procedures.

Output

The output resulting from the input of Table A1 is given in Tables A2a and A2b. Note in Table A2a that all field records are retained along with the desired output--percentage of soil moisture by volume. The percentages of soil moisture, along with the necessary identification, are placed on magnetic tape for permanent storage. An example listing of this data is shown in Table A2b. The data are stored according to a 132-character card image. The output for the permanent storage tape (S.SU01) is shown below. This exact format may be used to read data from the storage tape. Also note that in this conjunction a $File card similar to the one shown in Appendix list A1 for utility unit 01 would have to be used.

1-6	7-12	13-15	16-19	21-26	29-31	34-40
+XXXXX	+XXXXX	+XX	+XXX	XXXXXX	XXX	XXXXXXX
IWD	MO	ND	NYR	NSITE(I)	NTEBE(I)	NTEMP(I)

41-47	48-54	55-61	62-68	69-75	76-84
+XXXXX.	+XXXXX.	+XXXXX.	+XXXXX.	+XXXXX.	+XXXXXXX.
COUNTS(1)	COUNTS(2)	COUNTS(3)	COUNTS(4)	COUNTS(5)	SUMC

APPENDIX A1 -- Continued (2)

85-93	94-104	105-116	125-127	128-132
+XXXXXX.X	+XXXXXXX.XX	+XXXXXXXX.XX	XXX	+XXXX
AVG	PCSTD	PCMOIS	NUP	NCONT

APPENDIX A3 -- Detailed Description of the Variable Used in Appendix A2

Input

Symbol	Description
COUNTS(I) I = 1,5	Number of counts obtained by scaler.
DP(L,I) L = 1,304 I = 1,2	Coordinate points from the calibration curve for depth probe No. 1 I = 1: Percent standard. I = 2: Percent moisture
DPN(L,I) L = 1,304 I = 1,2	Coordinate points from the calibration curve for depth probe No. 2 I = 1: Percent standard. I = 2: Percent moisture.
I	Variable integer used to index COUNTS(I), NDIND2(I), NOTES(I), NSITE(I), and NTUBE(I). The variable I that is given as indexes for DP(L,I), DPN(L,I), and SP(L,I) is a dummy variable that is used to indicate the second dimension of the respective matrices.
IWD	Watershed identification code.
JJ	Variable integer used to identify the upper limit of read loop.
KODE	Variable index code used in branching instructions. See bottom of table C1.
L	Variable integer used to index DP(L,I), DPN(L,I), and SP (L,I).
METER	Index code having possible values of 1, 2, 3, or 4. METER = 1: Depth probe No. 1. METER = 2: Depth probe No. 2. METER = 3: Depth probe No. 3. METER = 4: Surface probe No. 2.
MO	Two digit integer representing the month of the year.
ND	Two digit integer representing the day of the month.
ND1ND2(I) I = 1,7	Depth at which reading was taken, e.g., surface, 12 IN., 24 IN., etc. The depth field is read as 7 one-digit alphameric words.
NDP	Index code that locates the lower limit of the read loop for table DP(L,I).
NDPN	Index code that locates the lower limit of the read loop for table DPN(L,I)
NEND	Index code that initiates specific logical operations. When loading the soil moisture tables DP(L,I), DPN(L,I), and SP(L,I) this code specifies when the respective tables have been completely loaded. For this function NEND is used as follows: NEND = 0: More cards to be loaded. NEND = 9: The table has been loaded. NEND is also used in conjunction with the basic input data and has the following function: NEND = 0 or (blank): Normal processing which implies that there will be more data to follow. NEND = 9: End of intermediate station record. This implies that 2 or more station records are being processed. NEND = 99: Terminates all processing after the last data card (the one containing the 99) has been processed.
NOTES(I) I = 1,9	Notes explaining weather conditions, sampling conditions, etc. (See sample input data table C1).
NSITE(I) I = 1,3	Sampling site identification number(s) or letter(s) or both. The site identification is read as a 6 one-digit alphameric word.
NSP	Index code that locates the lower limit of the read loop for table SP(L,I).
NTUBE(I) I = 1,3	Moisture tube identification, e.g., A, B, C, D, 1, 2, etc. The tube identification field is read as 3 one-digit alphameric words.
NUP	Update identification code.
NYR	Two-digit integer representing the last two digits of year.
SP(L,I) L = 1,112 I = 1,2	Coordinate points from the calibration curve for the surface moisture meter.

Output

AVG	Average counts per minute.
COUNTS(I) I = 1,5	See Input.
I	See Input.
IWD	See Input

KPAGE	Sequential page number.
MO	See Input.
NCONT	Sequential list for data output via S.SU01.
ND	See Input.
NOTES(I) I = 1,9	See Input.
NSITE(I) I = 1,6	See Input.
NTEBE(I) I = 1,3	See NTUBE(I) in the Input section.
NTEMP(I) I = 1,7	See ND1ND2(I) in the Input section.
NUMBER	Sequential list number for data output via S.SU06
NUP	See Input.
NYR	See Input.
PCMOIS	Percent moisture by volume.
PCSTD	Percent standard.
SUMC	Accumulated sum of the counts made at a given setting, e.g., the sum of three one-minute readings.

PROGRAM

(Input/output variables are not included)

ANUM	Number of one-minute counts made at a given setting.
CHANGE	A six-digit blank alphameric data field that is used to replace zeros in the COUNT(I) vector. The result of this replacement is that blank spaces in place of zeros will appear under the heading COUNTS (Table C2a).
DULP(I) I = 1,2	Two six-digit alphameric data fields that are used to develop output formats.
F610(I) I = 1,17	Variable output format.
F620(I) I = 1,15	Variable output format.
F621(I) I = 1,16	Variable output format.
F624(I) I = 1,16	Variable output format.
F625(I) I = 1,16	Variable output format.
I	Variable index.
ICOUNT	Variable index.
J	Variable index.
JJ	Variable index.
L	Variable index.
LBR	Variable index used in branching instruetions.
LI	Variable index.
LINES	Count of number of lines written per page.
LK	Variable index.
LM	Variable index.
LOW	Lower limit of do loop for building format statement.
LUP	Upper limit of do loop for building format statement.
NBRANH	Variable index used in branching instructions.
NCHK(I) I = 1,3	Three one-digit alphameric data fields. These three are ., -, and blank space.
NDECS(I) I = 1,15	All data in input vectors ND1ND2(I), NSITE(I), and NTUBE(I) must be right justified prior to writing on storage tape (S.SU01). The alphameric characters stored in vector NDECS(I) are the only valid ones allowed on the permanent storage output tape (S.SU01).
NSNST(I) I = 1,6	Temporary storage for NSITE(I).
STOP(I) I = 1,4	Standard count for depth probes.
STDSP(I) I = 1,4	Standard count for surface probes.

SECTION 3 (BMDO2V)

Computer programs for many types of statistical applications are available to most computing facilities. Section 3 was abstracted from the VPI program library. This program was developed to determine the analysis of variance for a factorial designed experiment. A copy of the program may be obtained by writing to the VPI Computing Center, VPI, Blacksburg, Virginia.

Section 2 was specifically designed to use program BMDO2V, however, the output is sufficiently general to allow for almost any type of statistical analysis. The input to BMDO2V is in punch card form. If it is more convenient for this input (output from Section 2) to be on magnetic tape or disk, simply place the appropriate disk or tape rewind statement at the beginning of the source program (Section 2) and the number of the disk or tape unit in the affected write statements.

A general description of program BMDO2V is presented for reference. The presentation is as released by the VPI Computing Center.

General Description

1. This program computes an analysis of variance for a factorial design.
2. Output for this program includes:
   (a) Analysis-of-variance table and the grand mean.
   (b) A breakdown of the sums of squares into orthogonal polynomial components for as many as four main effects in all of their first order interactions.
   (c) Main effects and first order interactions for the variables specified in (b).
   (d) Cell and marginal means.
3. Limitations per problem:
   (a) W, number of variables or ways ($W < 8$)
   (b) R, number of replicates ($R < 999$)
   (c) L_i, number of categories or levels of any one variable
   ($L_i < 999$) and $L_1 \times L_2 \times L_3 \times \ldots \times L_w < 18{,}000$)
   (d) k, number of Variable Format Cards ($1 < k < 5$)
4. Estimation of running time and output pages per problem:
   Number of seconds = $(W \cdot R + 90)$ (for IBM 7094)
   Number of pages = 5
   $+\Sigma L_i/60$ if marginal means requested
   $+\Pi L_i/60$ if cell means requested
5. The program can perform transgenerations of input data, if desired, according to the codes specified on one Special Transgeneration Card. Codes 01 through 10 of the transgeneration list may be used.

Order of Cards in Job Deck

Cards indicated by letters enclosed in parentheses are optional. All other cards must be included in the order shown.

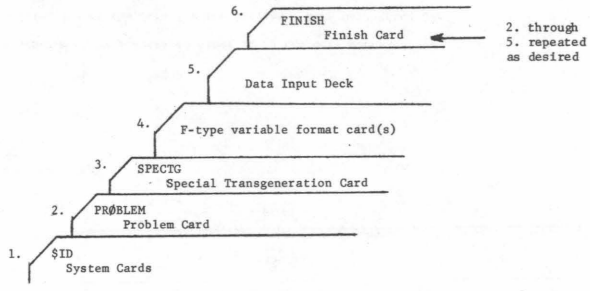
1. System Cards
2. Problem Card
3. Special Transgeneration Card
4. F-type Variable Format Card(s)
5. DATA INPUT Cards
   (Place data input deck here if data input is from cards.)

   . . .

   Repeat 2 through 5 as desired.

   . . .
6. Finish Card

Example of Job Deck Set-up:



Card Preparation (Specific for this Program)

Preparation of the cards listed below is specific for this program.

All other cards are prepared according to instructions in the introduction.

2. Problem Card (One Problem Card for each problem)

Col. 1-6 PRØBLM (Mandatory)

Col. 7,8 Problem number (alphanumeric)

Col. 9-11 Number of replicates (R 999)

Col. 12 Number of variables (W 8)

Col. 13 1 If Special Transgeneration Card Follows; blank otherwise

Col. 14 2 If cell and marginal means are to be printed;

1 If only marginal means are to be printed;

If no means are desired, leave this column blank.

Col. 15,16 Number of input data fields per card. See the Data Input Card section below.

Col. 17 Number of variables for which an orthogonal polynomial breakdown is desired (4). Only variables with 9 or fewer levels may be used in this breakdown. The variables are specified in ascending order (see Data Input Dard section below) in the following 4 columns. If no breakdown is desired, leave Columns 17-21 blank.

Note: To identify variables by number, refer to the Data Input section.

Col. 18 1st variable for orthogonal polynomial breakdown

Col. 19 2nd variable for orthogonal polynomial breakdown

Col. 20 3rd variable for orthogonal polynomial breakdown

Col. 22-24 Number of levels in the 1st analysis-of-variance variable.

Col. 25-27 Number of levels of the 2nd analysis-of-variance variable.

Col. 28-30 Number of levels of the 3rd analysis-of-variance variable.

. . .

Col. 43-45 Number of levels of the 8th analysis-of-variance variable.

Col. 46-68 Blank

Col. 69,70 If data input is from a tape other than the standard input tape, punch that tape unti number; otherwise, leave blank.

Col. 71,72 Number of Variable Format Cards (1 k 5)

5. Data Input Cards

The form of the data input is illustrated in the following example, which consists of a 3-variable design where 2 variables have 3 levels, the other has 2 levels, and the entire experiment is replicated twice. The data may be represented in the form:

x_{rijk} r = 1, 2 (Replicates)
i = 1, 2, 3 (Variables)
j = 1, 2, 3
k = 1, 2

The program considers the variable

i as variable 1
j as variable 2
k as variable 3

In preparing data for analysis, each replicate of the design must start on a new card. Within each replicate, the data re lexicographically ordered by their subscripts. That is, the subscript on the right, namely variable 3, is incremented first, then variable 2 and finally, variable 1.

x_{r111}

x_{r112}

x_{r121}

x_{r122}

x_{r131}

x_{r132}

x_{r211}

.

.

.

x_{r332}

This order must be maintained since it is the only means of identification of the data for the program. Each Data Input Card must have the same format, and this format must be specified on the F-type Variable Format Card. The number of data fields per card must be specified in Columns 15, 16 of the Problem Card. Unused fields, if any, in the last card for each replicate may be left blank.

Computational Procedures

Step 1. The calculations performed by this program will be demonstrated, using as an example of a 3-way analysis of variance with R replications.

Let x_{rijk} $\quad r = 1, 2, \ldots, R$

$i = 1, 2, \ldots, I$

$j = 1, 2, \ldots, J$

$k = 1, 2, \ldots, K$

Step 2. The first item computed is the grand mean $\bar{x}$ ....

The TOTAL and the WITHIN sums of squares are computed:

$$\text{TOTAL} = \sum_r \sum_i \sum_j \sum_k (x_{rijk} - \bar{x}....)^2$$

$$\text{WITHIN} = \sum_r \sum_i \sum_j \sum_k (x_{rijk} - \bar{x}_{.ijk})^2$$

and the means over replications are taken $\bar{x}_{.ijk}$

Step 3. The grand mean is subtracted from these to obtain

$(\bar{x}_{.ijk} - \bar{x}....)$ $\quad i = 1, 2, \ldots, I$

$j = 1, 2, \ldots, J$

$k = 1, 2, \ldots, K$

Step 4. Sums of squares are then computed using formulas of the type:

$$A = \frac{R}{IJK} \left[I \sum_i \left(\sum_j \sum_k (\bar{x}_{.ijk} - \bar{x}....) \right)^2 \right]$$

$$B = \frac{R}{IJK} \left[J \sum \left(\sum \sum (\bar{x}_{.ijk} - \bar{x}....) \right)^2 \right]$$

$$C = \frac{R}{IJK}\left[\sum_{k}^{K}\left(\sum_{i}^{\Sigma}\sum_{j}^{\Sigma}(\bar{x}_{.ijk} - \bar{x}_{....})\right)^2\right]$$

$$AB = \frac{R}{IJK}\left[\sum_{i}^{I}\sum_{j}^{J}\left(\sum_{k}^{\Sigma}(\bar{x}_{.ijk} - \bar{x}_{....})\right)^2\right] - (A + B)$$

$$AC = \frac{R}{IJK}\left[\sum_{i}^{I}\sum_{k}^{K}\left(\sum_{j}^{\Sigma}(\bar{x}_{.ijk} - \bar{x}_{....})\right)^2\right] - (A + C)$$

$$BC = \frac{R}{IJK}\left[\sum_{j}^{J}\sum_{k}^{K}\left(\sum_{i}^{\Sigma}(\bar{x}_{.ijk} - \bar{x}_{....})\right)^2\right] - (B + C)$$

ABC = TOTAL − WITHIN − (A + B + C + AB + AC + BC)

Step 5. If requested on the Problem Card, a breakdown of certain main effect and first order interaction sums of squares into orthogonal polynomial components is made. The nature of these computations is explained in the following example.

The first and third variables of the previous example are designated for this analysis. (This means I and K are less than or equal to 9.)

Let $x_{i++} = \sum_{j}^{\Sigma}\sum_{k}^{\Sigma}\bar{x}_{.ijk}$

$x_{++k} = \sum_{i}^{\Sigma}\sum_{j}^{\Sigma}\bar{x}_{.ijk}$

$x_{i+k} = \sum_{j}^{\Sigma}\bar{x}_{.ijk}$

The following matrices are printed:

$$X_i = \begin{vmatrix} x_{1++} \\ x_{2++} \\ \cdot \\ \cdot \\ \cdot \\ x_{I++} \end{vmatrix}, \quad X_k = \begin{vmatrix} x_{++1} \\ x_{++2} \\ \cdot \\ \cdot \\ \cdot \\ x_{++K} \end{vmatrix}; \quad X_{ij} = \begin{vmatrix} x_{1+1} & x_{1+2} \cdots x_{1+K} \\ x_{2+1} & x_{2+2} \cdots x_{2+K} \\ \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot \\ x_{1+1} & x_{1+2} & x_{1+k} \end{vmatrix}$$

Let

$$P_\ell = \begin{vmatrix} P_{11} & P_{12} & \cdots & P_{1\ell} \\ P_{21} & P_{22} & \cdots & P_{2\ell} \\ & & & \\ P_{\ell-1,1} & P_{\ell-1,2} & \cdots & P_{\ell-1,\ell} \end{vmatrix}$$

where P_{ij} is the j^{th} value of the orthogonal polynomial of degree i defined in ℓ equally spaced points. The following matrix multiplications are performed:,

$P_I \; X_i$, $P_K \; X_k$, $P_I \; X_{ik} \; P_K$

When the elements of these matrices are squared and divided respectively by the constants J · K/R, I · >1Θ´ αvϕ

the resulting matrices are printed. They represent respectively the orthogonal polynomial components of the sums of squares for the i main effect, the k main effect, and the i x k interaction. In the case when these matrices have more than 3 rows or columns (i.e. when I or K > 4), all the rows beyond the first 3 are replaced by their sum; then all the columns of the resulting matrices beyond the first 3 are replicated by their sum. These final matrices are printed under the row and column headings, LINEAR, QUADRATIC, CUBIC, REMAINDER.

Step 6. For every pair of variables treated in Step 5, a table of main effect and interaction means is printed. For the example given in Step 5, this table would be

$$\left[\bar{x}_{.i.k}-\bar{x}_{.i..}-\bar{x}_{...k}+\bar{x}_{....}\right]_{I \times K} \qquad \left[\bar{x}_{.i..}-\bar{x}_{....}\right]_{I \times 1}$$

$$\left[\bar{x}_{...k}-\bar{x}_{....}\right]_{1 \times K} \qquad \left[\bar{x}_{....}\right]_{1 \times 1}$$

Step 7. For every pair of variables treated in Step 5, a table of means is printed. For the example in Step 5, this table would be

$$\left[\bar{x}_{.i.k}\right]_{I \times K} \qquad \left[\bar{x}_{.i..}\right]_{I \times 1}$$

$$\left[\bar{x}_{...k}\right]_{I \times K} \qquad \left[\bar{x}_{....}\right]_{1 \times 1}$$

Step 8. If requested on the Problem Card, cell and marginal means are printed. For the example, in Step 5, these include

$$\bar{x}_{.ijk} \quad \bar{x}_{.i..} \quad \bar{x}_{..jk} \quad \bar{x}_{...k}$$

for i = 1, ...,I; j = 1, ...,J; k = 1,...,K

APPENDIX B

Program Listing and Descriptions
of Variables for Soil Moisture

Reduction -- Section II

```
$IBFTC SM
      INTEGER PAGE,DPINC,TRCOMB,TYPE
      DIMENSION PART1(2),AS(30)
      DIMENSION DEPINV(12),AINCH(3),PART(2)
      DIMENSION TPFORM(50),BKCODE(50),TRCODE(50),DEPTHT(15),DEPCOD(15),T
     1UBET(50),TUBCOD(50),OUTIDX(5),CHK(2),CONV(15),ALPH(8)
      DIMENSION BTD(12,12,12),AIJL(12,12,12),ACSM(17),AC(17),AMX(17),AMN
     1(17)
      DIMENSION AMO(12)
      DIMENSION PLTMAT(124,50),NDT(3),SCALE(3,16),ONHAL(3), INCH(3),DPIN
     1C(17)
      DIMENSION MONTH(12),INWAT(16)
      DIMENSION NT(5),GRPS(24)
      DIMENSION ABSC(7),ACC(12),TRCOMB(75),GROUP(15),SUMGRP(15,36),ANGRP
     1S(15,36),AMX2(17),AMN2(17),AMX3(12),AMN3(12),OT(16),OUT(20),OUTT(2
     2)
      DATA FORM/6H(I4,3X/,FORM1/6H,5I3, /
      DATA ABSC/1HO,1H1,1H2,1H3,1H5,1H8,1H9/
      DATA ZERO/1HO/
      DATA INWAT/1H ,1H ,1HI,1HN,1HC,1HH,1HE,1HS,1H ,1HW,1HA,1HT,1HE,1HR
     1,1H ,1H /
      DATA OUT/118H(I4,5X,I4,4X
     1                                                    3I4)/
      DATA OT/96H(I4,5X,I3,4X
     1                          1X,3I3)     /
      DATA DPINC/3,6,9,12,15,18,21,24,27,30,36,42,48,54,60,66,72/
      DATA MONTH/31,28,31,30,31,30,31,31,30,31,30,31/
      DATA OUTT/12HF6.2 ,A6    ,/,BLKSP/6H      /
      DATA AMO/72H JAN.  FEB.  MAR.  APR.  MAY   JUNE  JULY  AUG.  SEPT
     1 OCT.  NOV.  DEC. /
      DATA BLANK/1H /,PLUS/1H+/,STAR/1H*/,PERD/1H./,XES/1HX/,AAS/1HA/
      DATA CHK/2HIN,2HFT/,BLK3/3H    /
      DATA DEPINV/72H 00-06 06-12 12-18 18-24 24-30 30-36 36-42 42-48 48
     1-54 54-60 60-66 66-72/
      DATA PART/5HAVAIL,5HTOTAL/
      DATA FORM2,FORM3/6H(I4,2X,6H5I2,1X/
      DATA PART1/5HBLOCK,5HGROUP/
      REWIND 0
  505 CONTINUE
      REWIND 1
      REWIND 8
      REWIND 9
      REWIND 10
      REWIND 11
      REWIND 12
  100 CONTINUE
      NRUN=0
      READ(5,5162)TYPE
 5162 FORMAT(I1)
      GO TO(5164,5167),TYPE
 5164 READ(5,5163)N3,N2,N1,B,AIJL(N3,N2,N1),NSTP
 5163 FORMAT(3I2,2F5.2,I2)
      BTD(N3,N2,N1)=B-AIJL(N3,N2,N1)
      IF(NSTP.NE.9)GO TO 5164
 5167 CONTINUE
      N5=0
      NABS=0
      WRITE(6,624)
  624 FORMAT(1H1,27X,25HIDENTIFICATION DICTIONARY)
      LINES=0
      KLBR=0
      NCHECK=0
 3088 INDEX1=1
      KK=1
    1 READ(5,1000)TPFORM(INDEX1),BKCODE(INDEX1),TRCODE(INDEX1),KODE9
 1000 FORMAT(A6,2A2,69X,I1)
      IF(KODE9.EQ.9)GO TO 10
      INDEX1=INDEX1+1
      GO TO 1
   10 CONTINUE
      WRITE(6,623)
  623 FORMAT(1HO,31X,15HBLOCK-TREATMENT)
      DO 621 I=1,INDEX1
      WRITE(6,622)TPFORM(I),BKCODE(I),TRCODE(I)
  622 FORMAT(10X,6(A6,2A2))
      IF(LINES.GE.52)GO TO 631
      LINES=LINES+1
  621 CONTINUE
 3089 INDEX2=1
      KK=2
    2 READ(5,1001)DEPTHT(INDEX2),DEPCOD(INDEX2),CONV(INDEX2),KODE9
 1001 FORMAT(F2.0,A2,F5.0,70X,I1)
      IF(KODE9.EQ.9)GO TO 11
      INDEX2=INDEX2+1
      GO TO 2
   11 CONTINUE
      WRITE(6,625)
  625 FORMAT(1HO,34X,5HDEPTH)
      DO 626 I=1,INDEX2
      WRITE(6,627)DEPTHT(I),DEPCOD(I),CONV(I)
  627 FORMAT(10X,3(F8.0,A2,F10.0))
      IF(LINES.GE.52)GO TO 631
      LINES=LINES+1
  626 CONTINUE
 3090 INDEX3=1
      KK=3
    3 READ(5,1002)TUBET(INDEX3),TUBCOD(INDEX3),KODE9
 1002 FORMAT(A3,A2,74X,I1)
      IF(KODE9.EQ.9)GO TO 12
      INDEX3=INDEX3+1
      GO TO 3
   12 CONTINUE
      WRITE(6,628)
  628 FORMAT(1HO,27X,25HLOCATION WITHIN TREATMENT)
      DO 629 I=1,INDEX3
      WRITE(6,630)TUBET(I),TUBCOD(I)
  630 FORMAT(10X,6(5X,A3,A2))
      IF(LINES.GE.52)GO TO 631
      LINES=LINES+1
  629 CONTINUE
```

```
      GO TO 13
  631 WRITE(6,632)
  632 FORMAT(1H1,24X,31HIDENTIFICATION DICTIONARY-CONTD)
      IF(KK.NE.1)GO TO 634
      WRITE(6,633)
  633 FORMAT(1HO,28X,21HBLOCK-TREATMENT-CONTD)
      LINES=0
      GO TO 621
  634 IF(KK.NE.2)GO TO 636
      WRITE(6,635)
  635 FORMAT(1HO,31X,11HDEPTH-CONTD)
      LINES=0
      GO TO 626
  636 IF(KK.NE.3)GO TO 13
      WRITE(6,637)
  637 FORMAT(1HO,24X,31HLOCATION WITHIN TREATMENT-CONTD)
      LINES=0
      GO TO 629
   13 CONTINUE
      READ(5,1004)BEG1,BEG2,END1,END2,KARDS,KUNIT6,KUNIT1,NDUP,NBLKS,NTR
     1TS,NDPS,MAXDP1,MAXDEP,NEND,NGX5,(TRCOMB(I),I=1,NGX5),NERR
 1004 FORMAT(2(A3,A5),3II2/40I2/30I2)
      CALL CHKPT(30)
      AMXDEP=MAXDP1
      AKARDS=KARDS
      KBEG=0
      N5=N5+1
      IF(KUNIT6.EQ.0)WRITE(6,2001)
 2001 FORMAT(79H1SORT CODE     TOTAL WATER FOR HORIZON          DATE OF
     1RDG              SEQ NO.)
      NSEQ=0
      LIST=1
      K=0
      NTIMES=0
    5 READ(0,1005)MO,ND,NYR,ASITE,ATEBE,ATEM1,ATEM2,PCMOIS,ANUP,ANCONT
 1005 FORMAT(6X,I6,I3,I4,1X,A6,2X,A3,2X,F5.0,A2,64X,F12.2,8X,A3,A5)
      IF(BEG1.EQ.ANUP.AND.BEG2.EQ.ANCONT)K=1
      IF(K.EQ.0)GO TO 5
      K=K+1
      IF(K.NE.1)GO TO 18
      ANYR=NYR
      ANYR=ANYR/4.
      NNYR=ANYR
      ANNYR=NNYR
      MONTH(2)=28
      IF(ANNYR.EQ.ANYR)MONTH(2)=29
   18 CONTINUE
      DO 20 I=1,INDEX1
      IF(TPFORM(I).EQ.ASITE)GO TO 21
   20 CONTINUE
      GO TO 200
   21 OUTIDX(3)=BKCODE(I)
      OUTIDX(2)=TRCODE(I)
      MM=I
      DO 30 I=1,INDEX2
      IF(DEPTHT(I).EQ.ATEM1)GO TO 31
   30 CONTINUE
      GO TO 210
   31 OUTIDX(1)=DEPCOD(I)
      IF(CHK(1).EQ.ATEM2)GO TO 36
      CON=CONV(I)*12.
      GO TO 35
   36 CON=CONV(I)
   35 CONTINUE
      WRITE(11,5165)(OUTIDX(I),I=1,3)
 5165 FORMAT(3A2)
      REWIND 11
      READ(11,5166)N1,N2,N3
 5166 FORMAT(3I2)
      REWIND 11
      GO TO(5168,5169),TYPE
 5169 WATER=PCMOIS*.01*CON
      NW=WATER*100.+.5
      GO TO 5179
 5168 CONTINUE
      WATER =PCMOIS-AIJL(N3,N2,N1)
      IF(WATER.GE.0..AND.WATER.LE.BTD(N3,N2,N1))GO TO 5170
      IF(WATER.LT.0.)GO TO 5171
      PCMOIS=BTD(N3,N2,N1)
      GO TO 5169
 5170 PCMOIS=WATER
      GO TO 5169
 5171 PCMOIS=0.
      GO TO 5169
 5179 CONTINUE
      IF(ATEBE.NE.BLK3)GO TO 37
      I=1
      GO TO 41
   37 CONTINUE
      DO 150 I=1,INDEX3
      IF(TUBET(I).EQ.ATEBE)GO TO 41
  150 CONTINUE
      GO TO 220
   41 OUTIDX(4)=TUBCOD(I)
      IF(NDUP.EQ.0)GO TO 3093
      IF(AKARDS.EQ.1..OR.ATEM1.GT.0.)GO TO 3093
      DO 3094 I=1,NDUP
      NSEQ=NSEQ+1
      IF(KUNIT6.EQ.0)WRITE(6,2000)(OUTIDX(JJ),JJ=1,3),N5,I        ,WATER
     1,MO,ND,NYR,ANUP,NSEQ
 2000 FORMAT(1X,3A2,I2,I2,10X,F7.2,21X,3I3,14X,A3,I5)
      IF(KUNIT1.EQ.0)WRITE(1,2003)(OUTIDX(J),J=1,3),N5,I,        WATER,M
     1O,ND,NYR,ANUP,ANCONT
 2003 FORMAT(3X,3A2,2I2,10X,F8.4,21X,3I3,14X,A3,A5)
      LGO=2
      GO TO 579
 3094 WRITE(7,2002)(OUTIDX(J),J=1,3),N5,I,        NW,MO,ND,NYR,ANUP,NSEQ
 2002 FORMAT(3A2,I2,I2,9X,I6,24X,3I3,14X,A3,I5)
      GO TO 3096
 3093 CONTINUE
```

```
      NSEQ=NSEQ+1
      IF(KUNIT6.EQ.0)WRITE(6,2007)(OUTIDX(I),I=1,3),N5,OUTIDX(4),WATER,M
     10,ND,NYR,ANUP,NSEQ
 2007 FORMAT(1X,3A2,I2,A2,10X,F7.2,21X,3I3,14X,A3,I5)
      IF(AKARDS.EQ.0..AND.ATEM1.LE.AMXDEP)WRITE(7,2008)(OUTIDX(I),I=1,3)
     1,N5,OUTIDX(4),NW,MO,ND,NYR,ANUP,NSEQ
 2008 FORMAT(3A2,I2,A2,9X,I6,24X,3I3,14X,A3,I5)
      IF(KUNIT1.EQ.0)WRITE(1,2009)(OUTIDX(I),I=1,3),N5,OUTIDX(4),WATER,M
     10,ND,NYR,ANUP,ANCONT
 2009 FORMAT(3X,3A2,I2,A2,10X,F8.4,21X,3I3,14X,A3,A5)
 3096 CONTINUE
      IF(KBEG.EQ.1)GO TO 7657
      KBEG=1
      BEG3=ANUP
      BEG4=ANCONT
 7657 CONTINUE
      LGO=1
      END3=ANUP
      END4=ANCONT
      IF(KUNIT6.GT.0)GO TO 61
  579 IF(LIST.LT.54)GO TO 60
      LIST=0
      WRITE(6,2001)
   60 LIST=LIST+1
      GO TO(61,3094),LGO
   61 IF(END1.EQ.ANUP.AND.END2.EQ.ANCONT)GO TO 400
      GO TO 5
  200 WRITE(8,300)ASITE,ANUP,ANCONT
  300 FORMAT(18HUNDEFINED VARIABLE,2X,A6,10X,A3,A5)
      GO TO 62
  210 WRITE(8,301)ATEM1,ANUP,ANCONT
  301 FORMAT(18HUNDEFINED VARIABLE,3X,F5.0,10X,A3,A5)
      GO TO 62
  220 WRITE(8,302)ATEBE,ANUP,ANCONT
  302 FORMAT(18HUNDEFINED VARIABLE,5X,A3,10X,A3,A5)
   62 NTIMES=NTIMES+1
      GO TO 61
  400 IF(NTIMES.EQ.0)GO TO 419
      IF(NERR.EQ.1)GO TO 419
      REWIND 8
      WRITE(6,2333)
 2333 FORMAT(1H1)
      DO 405 L=1,NTIMES
      READ(8,415)(ALPH(I),I=1,8)
  415 FORMAT(7A6,A2)
      WRITE(6,416)(ALPH(I),I=1,8)
  416 FORMAT(1X,7A6,A2)
  405 CONTINUE
      REWIND 8
  419 CONTINUE
      WRITE(9,9999)BEG3,BEG4,END3,END4,NBLKS,NTRTS,NDPS,MAXDEP,NEND,NGX5
     1,(TRCOMB(I),I=1,NGX5)
 9999 FORMAT(11O12/11O12/11O12/11O12/11O12/11O12/11O12/11O12)
 8888 IF(NEND.EQ.8)GO TO 13
      IF(KUNIT1.EQ.0.AND.(NEND.EQ.9.OR.NEND.EQ.99))GO TO 9059
      IF(NEND.EQ.99)CALL EXIT
      GO TO 100
 9059 CONTINUE
      LINES=0
      KGRPS=0
      REWIND 1
      REWIND 2
      REWIND 9
      PAGE=1
      DO 6110 I=1,12
      ACC(I)=0.
      AMX2(I)=0.
      AMX3(I)=0.
      AMN2(I)=99.
 6110 AMN3(I)=99.
      DO 6100 I=1,17
      AMX(I)=0.
 6100 AMN(I)=99.
      WRITE(6,9001)PAGE
 9001 FORMAT(1H1,122X,4HPAGE,I4)
      WRITE(6,9101)PART1(1),PART(TYPE)
 9101 FORMAT(          1X,A5,10H TREATMENT,31X,12HACCUMULATED ,A5,24H SO
     1IL MOISTURE FROM 0 TO,35X,4HDATE/19X,112H3IN   6IN   9IN   12IN  1
     25IN  18IN  21IN  24IN  27IN  30IN  36IN  42IN  48IN  54IN  60IN  6
     36IN  72IN  MO DAY  YR)
 9060 DO 6020 I=1,12
      DO 6020 J=1,12
      DO 6020 L=1,12
      BTD(I,J,L)=0.
 6020 AIJL(I,J,L)=0.
      DO 8833 I=1,15
      DO 8833 J=1,36
      ANGRPS(I,J)=0.
 8833 SUMGRP(I,J)=0.
      KOD=0
C
C     PARAMETER CARD
C
      READ(9,9999)BEG1,BEG2,END1,END2,NBLKS,NTRTS,NDPS,MAXDEP,NEND,NGX5,
     1(TRCOMB(I),I=1,NGX5)
      JJJ=0
      DO 50 I=1,NGX5,5
      JJ=I+4
      JJJ=JJJ+1
      GROUP(JJJ)=0.
      DO 49 J=I,JJ
      IF(TRCOMB(J).EQ.0)GO TO 49
      GROUP(JJJ)=1.
      GO TO 50
   49 CONTINUE
   50 CONTINUE
      NSPACE=NTRTS*NBLKS
      K=0
 8999 READ(1,9000)N1,N2,N3,N4,WATER,MO,ND,NYR,ANUP,ANSEQ
 9000 FORMAT(3X,4I2,12X,F8.4,21X,3I3,14X,A3,A5)
```

```
      IF(ANUP.EQ.BEG1.AND.ANSEQ.EQ.BEG2)K=1
      IF(K.EQ.0)GO TO 8999
 9501 BTD(N3,N2,N1)=BTD(N3,N2,N1)+WATER
      AIJL(N3,N2,N1)=AIJL(N3,N2,N1)+1.
      IF(ANUP.EQ.END1.AND.ANSEQ.EQ.END2)GO TO 9002
      READ(1,9000)N1,N2,N3,N4,WATER,MO1,ND1,NYR1,ANUP,ANSEQ
      GO TO 9501
 9002 CONTINUE
      DO 6037 I=1,NBLKS
      DO 6040 J=1,NTRTS
      DO 6043 L=1,NDPS
      IF(BTD(I,J,L).EQ.0.)GO TO 6044
      AVG=BTD(I,J,L)/AIJL(I,J,L)
      GO TO 6045
 6044 AVG=0.
 6045 CONTINUE
      BTD(I,J,L)=AVG
      AIJL(I,J,L)=0.
 6043 CONTINUE
      DO 6046 III=1,17
      AC(III)=0.
      OUT(III+2)=OUTT(2)
 6046 ACSM(III)=BLKSP
      DO 3588 I4=1,24
 3588 AS(I4)=0.
      BOTTOM =0.
      IND=1
      INDX=1
      SUM=0.
      DO 6047 LL=1,NDPS
      IF(BTD(I,J,LL).NE.0.)GO TO 6048
      IF(LL.GT.1)GO TO 6047
      IF(BTD(I,J,LL+1).EQ.0.)GO TO 6047
      THREE=CONV(LL+1)/3.
      AMT=BTD(I,J,LL+1)/THREE
      NTH=CONV(LL)/3.
      GO TO 6049
 6048 THREE=CONV(LL)/3.
      AMT=BTD(I,J,LL)/THREE
      NTH=THREE
      BTD(I,J,LL)=0.
 6049 CONTINUE
      DO 6051 MARY=1,NTH
      SUM=SUM+AMT
      AS(IND)=SUM
      IND=IND+1
      BOTTOM=BOTTOM+3.
      IF(BOTTOM.GT.30.)GO TO 4562
 4563 CONTINUE
      AC(INDX)=SUM
      ACSM(INDX)=SUM
      OUT(INDX+2)=OUTT(1)
      IF(AMX(INDX).LT.AC(INDX))AMX(INDX)=AC(INDX)
      IF(AMN(INDX).GT.AC(INDX))AMN(INDX)=AC(INDX)
      INDX=INDX+1
      IF(BOTTOM.EQ.72.)GO TO 6050
      GO TO 6051
 4562 CONTINUE
      IF(BOTTOM.EQ.36..OR.BOTTOM.EQ.42..OR.BOTTOM.EQ.48..OR.BOTTOM.EQ.54
     1..OR.BOTTOM.EQ.60..OR.BOTTOM.EQ.66..OR.BOTTOM.EQ.72.)GO TO 4563
 6051 CONTINUE
 6047 CONTINUE
 6050 IF(LINES.LT.NSPACE)GO TO 6055
      LINES=0
      WRITE(6,9565)
 9565 FORMAT(1H )
 6055 IF(KGRPS.LT.48)GO TO 6052
      PAGE=PAGE+1
      WRITE(6,9001)PAGE
      WRITE(6,9101)PART1(1),PART(TYPE)
      KGRPS=0
      LINES=0
 6052 LINES=LINES+1
      KGRPS=KGRPS+1
      ACC(1)=AC(2)
      LJM=1
      DO 72 JM=4,10,2
      IF(AC(JM).EQ.0.)GO TO 74
      LJM=LJM+1
      ACC(LJM)=AC(JM)-AC(JM-2)
   72 CONTINUE
      DO 73 JM=11,17
      IF(AC(JM).EQ.0.)GO TO 74
      LJM=LJM+1
      ACC(LJM)=AC(JM)-AC(JM-1)
   73 CONTINUE
   74 CONTINUE
      DO 75 JM=1,LJM
      IF(ACC(JM).EQ.0.)GO TO 75
      IF(ACC(JM).GT.AMX2(JM))AMX2(JM)=ACC(JM)
      IF(ACC(JM).LT.AMN2(JM))AMN2(JM)=ACC(JM)
   75 CONTINUE
      LMJ=0
      DO 70 LMI=1,NGX5,5
      LMJ=LMJ+1
      IF(GROUP(LMJ).EQ.0.)GO TO 70
      JJ=LMI+4
      DO 71 LMII=LMI,JJ
      IF(TRCOMB(LMII).NE.J)GO TO 71
      DO 533 LN=1,12
      SUMGRP(LMJ,LN)=SUMGRP(LMJ,LN)+ACC(LN)
      IF(ACC(LN).EQ.0.)GO TO 533
      ANGRPS(LMJ,LN)=ANGRPS(LMJ,LN)+1.
  533 CONTINUE
      DO 451 LN=13,36
      SUMGRP(LMJ,LN)=SUMGRP(LMJ,LN)+AS(LN-12)
      IF(AS(LN-12).EQ.0.)GO TO 451
      ANGRPS(LMJ,LN)=ANGRPS(LMJ,LN)+1.
  451 CONTINUE
   71 CONTINUE
```

```
   70 CONTINUE
      WRITE(6,OUT)I,J,(ACSM(K),K=1,17),MO,ND,NYR
      WRITE(2)I,J,(AC(K),K=1,17),MO,ND,NYR,LL,KOD,(ACC(K),K=1,12)
      DO 76 KK=1,12
   76 ACC(KK)=0.
      DO 6053 INN=3,19
 6053 OUT(INN)=OUTT(2)
      DO 6054 NKL=1,17
      ACSM(NKL)=BLKSP
 6054 AC(NKL)=0.
 6040 CONTINUE
 6037 CONTINUE
      NLOW=-4
      NUPP=0
      N4=NGX5/5
      DO 8658 I=1,N4
      NLOW=NLOW+5
      NUPP=NUPP+5
      DO 8659 J=1,12
      IF(ANGRPS(I,J).EQ.0.)GO TO 8659
      SUMGRP(I,J)=SUMGRP(I,J)/ANGRPS(I,J)
      IF(AMX3(J).LT.SUMGRP(I,J))AMX3(J)=SUMGRP(I,J)
      IF(AMN3(J).GT.SUMGRP(I,J))AMN3(J)=SUMGRP(I,J)
 8659 CONTINUE
      WRITE(10,9999) I,(TRCOMB(JJ),JJ=NLOW,NUPP),(SUMGRP(I,JJ),JJ=1,12),
     1MO,ND,NYR,KOD
      DO 452 J=13,36
      IF(ANGRPS(I,J).EQ.0.)GO TO 452
      SUMGRP(I,J)=SUMGRP(I,J)/ANGRPS(I,J)
  452 CONTINUE
      WRITE(12,9999)I,(TRCOMB(JJ),JJ=NLOW,NUPP),(SUMGRP(I,JJ),JJ=13,36),
     1MO,ND,NYR,KOD
 8658 CONTINUE
      IF(NEND.EQ.8)GO TO 9060
      KOD=9
      WRITE(2)I,J,(AC(K),K=1,17),MO,ND,NYR,LL,KOD,(ACC(K),K=1,12)
      WRITE(10,9999) I,(TRCOMB(JJ),JJ=NLOW,NUPP),(SUMGRP(I,JJ),JJ=1,12),
     1MO,ND,NYR,KOD
      WRITE(12,9999)I,(TRCOMB(JJ),JJ=NLOW,NUPP),(SUMGRP(I,JJ),JJ=13,36),
     1MO,ND,NYR,KOD
      REWIND 2
      REWIND 10
      REWIND 12
      IF(NEND.EQ.99)GO TO 539
 6999 NABS=0
      DO 7000 I=1,123
      DO 7000 J=1,50
 7000 PLTMAT(I,J)=BLANK
      DO 94 I=1,123
      PLTMAT(I,1)=PLUS
      PLTMAT(I,16)=PLUS
      PLTMAT(I,17)=PLUS
      PLTMAT(I,32)=PLUS
      PLTMAT(I,33)=PLUS
   94 PLTMAT(I,48)=PLUS
C
C     PLOTTING ROUTINE
C
      READ(5,906)NBLOCK,NTREAT,NBL2,NTRT2,NBL3,NTRT3,NBL4,NTRT4,NGRP1,NG
     1RP2,NGRP3,NGRP4,(NDT(I),I=1,3),NEND1,NTYPLT
  906 FORMAT(17I2)
      IF((NTYPLT.EQ.3.OR.NTYPLT.EQ.4).AND.NCHECK.EQ.0)GO TO 8215
      GO TO(8214,8215,280,280),NTYPLT
 8215 IF(KLBR.NE.0)GO TO 8214
      DO 8218 I=1,12
      AMX(I)=AMX2(I)
 8218 AMN(I)=AMN2(I)
  539 KLBR=1
      WRITE(6,8224)PART(TYPE)
 8224 FORMAT(16H1BLOCK TREATMENT,26X, A5,18H SOIL MOISTURE FOR,26X, 4HDA
     1TE/17X,81H00-06 06-12 12-18 18-24 24-30 30-36 36-42 42-48 48-54 54
     2-60 60-66 66-72  MO DA YR)
      LINES=0
      KGRPS=0
      NCHECK=1
  267 READ(2)I,J,(AC(K),K=1,17),MO,ND,NYR,LL,KOD,(ACC(K),K=1,12)
      IF(KOD.EQ.9)GO TO 268
      DO 8444 LMM=1,12
      AC(LMM)=ACC(LMM)
      ACC(LMM)=BLKSP
      OT(LMM+2)=OUTT(2)
      IF(AC(LMM).EQ.0.)GO TO 8444
      ACC(LMM)=AC(LMM)
      OT(LMM+2)=OUTT(1)
 8444 CONTINUE
      IF(LINES.LT.NSPACE)GO TO 8439
      LINES=0
      WRITE(6,9565)
 8439 IF(KGRPS.LT.48)GO TO 8440
      WRITE(6,8224)PART(TYPE)
      KGRPS=0
 8440 LINES=LINES+1
      KGRPS=KGRPS+1
      WRITE(6,OT)I,J,(ACC(LOM),LOM=1,12),MO,ND,NYR
      GO TO 267
  268 CONTINUE
      REWIND 2
      IF(NEND.EQ.99)GO TO 534
      IF(NTYPLT.GE.3)GO TO 280
 8214 NUB=0
      DO 7002 I=1,3
      IF(NDT(I).NE.0)NUB=NUB+1
 7002 CONTINUE
      DO 7003 I=1,NUB
      NJ=NDT(I)
      NSC=(AMX(NJ)+.005)*100.
      ANSC=NSC
      AMX(NJ)=ANSC*.01
      NSC=(AMN(NJ)+.005)*100.
      ANSC=NSC
```

```
      AMN(NJ)=ANSC*.01
      BETW=AMX(NJ)-AMN(NJ)
      DIV15=BETW/15.
      N15=DIV15*100.
      AN15=N15
      AN15=AN15*.01
      A15=BETW-(15.*AN15)
      AMX(NJ)=AMX(NJ)+(.15-A15)
      SUM=AMX(NJ)
      DIVS=(AMX(NJ)-AMN(NJ))/15.
      SCALE(I,1)=SUM
      DO 7006 NL=2,16
      SUM=SUM-DIVS
 7006 SCALE(I,NL)=SUM
      ONHAL(I)=DIVS/2.
      NSC=(ONHAL(I)+.005)*100.
      ANSC=NSC
      ONHAL(I)=ANSC*.01
      INCH(I)=DPINC(NJ)
      AINCH(I)=DEPINV(NJ)
 7003 CONTINUE
      GO TO (7011,7011,244,470),NTYPLT
 7011 READ(2)I,J,(AC(K),K=1,17),MO,ND,NYR,LL,KOD,(ACC(K),K=1,12)
      IF(KOD.EQ.9)GO TO 7500
      GO TO(91,92),NTYPLT
   92 DO 8222 II=1,12
 8222 AC(II)=ACC(II)
   91 IF(I.EQ.NBLOCK.AND.J.EQ.NTREAT)GO TO 863
      IF(I.EQ.NBL2.AND.J.EQ.NTRT2)GO TO 864
      IF(I.EQ.NBL3.AND.J.EQ.NTRT3)GO TO 865
      IF(I.EQ.NBL4.AND.J.EQ.NTRT4)GO TO 866
      GO TO 7011
  863 ASTER=STAR
      GO TO 8000
  864 ASTER=XES
      GO TO 8000
  865 ASTER=AAS
      GO TO 8000
  866 ASTER=PERD
      GO TO 8000
 7013 CONTINUE
C
C     ORDINATE COMPUTATIONS
C
      DO 7020 J=1,NUB
      NJ=NDT(J)
      IF((AC(NJ).EQ.0..OR.AC(NJ).LT..005).AND.SCALE(J,16).NE.0.)GO TO 70
     120
      NSC=(AC(NJ)+.005)*100.
      ANSC=NSC
      AC(NJ)=ANSC*.01
      DO 7019 LM=1,16
      DIF=AC(NJ)-SCALE(J,LM)
      IF(DIF)7019,7022,7023
 7019 CONTINUE
      LM=LM-1
 7023 LIM=LM
      IF(DIF.GE.ONHAL(J))LIM=LM-1
      GO TO 7024
 7022 LIM=LM
 7024 GO TO(7040,7041,7042),J
 7040 NPLY=LIM
      GO TO 7043
 7041 NPLY=LIM+16
      GO TO 7043
 7042 NPLY=LIM+32
 7043 PLTMAT(NPLX,NPLY)=ASTER
 7020 CONTINUE
      GO TO(7011,7011,244,470),NTYPLT
C
C     ABSCISSA COMPUTATIONS
C
 8000 CONTINUE
      IF(NABS.NE.0)GO TO 8005
      NABS=1
      NBGMO=MO
      MOB=MO-1
 8005 NBR=MO-MOB
      IF(NBR.LT.0)GO TO 7501
      GO TO(8006,8007,8008,8009,8010),NBR
 8006 NPLX=ND
      GO TO 7013
 8007 NPLX=MONTH(MO-1)+ND
      GO TO 7013
 8008 NPLX=MONTH(MO-2)+MONTH(MO-1)+ND
      GO TO 7013
 8009 NPLX=MONTH(MO-3)+MONTH(MO-2)+MONTH(MO-1)+ND
      GO TO 7013
 8010 CONTINUE
 7501 NABS=0
C
C     MATTRIX FILLED---OUTPUT DATA AND RESET FOR NEXT 4 MONTHS
C
 7500 CONTINUE
      NN=1
      NSUM=0
      IF(NBR.EQ.5)GO TO 7787
      IF(NBR.LT.0)GO TO 7788
      NBGMOE=NBGMO+NBR-1
      GO TO 7789
 7787 NBGMOE=NBGMO+3
      GO TO 7789
 7788 NBGMOE=12
 7789 CONTINUE
      DO 7502 L=NBGMO,NBGMOE
      N=MONTH(L)
      NM=0
      NSUM=NSUM+N
      DO 7503 I=NN,NSUM
      NM=NM+1
```

```
      IF(NM.EQ.N)GO TO 7505
      IF(NM.EQ.5.OR.NM.EQ.10.OR.NM.EQ.15.OR.NM.EQ.20.OR.NM.EQ.25)GO TO 7
     1504
      GO TO 7503
 7504 CONTINUE
      IF(PLUS.EQ.PLTMAT(I,1))PLTMAT(I,1)=ZERO
      IF(PLUS.EQ.PLTMAT(I,17))PLTMAT(I,17)=ZERO
      IF(PLUS.EQ.PLTMAT(I,16))PLTMAT(I,16)=ZERO
      IF(PLUS.EQ.PLTMAT(I,32))PLTMAT(I,32)=ZERO
      IF(PLUS.EQ.PLTMAT(I,33))PLTMAT(I,33)=ZERO
      IF(PLUS.EQ.PLTMAT(I,48))PLTMAT(I,48)=ZERO
      IF(NM.NE.5)GO TO 7771
      PLTMAT(I,49)=ABSC(5)
      GO TO 7503
 7771 IF(NM.NE.10)GO TO 7772
      PLTMAT(I,49)=ABSC(2)
      PLTMAT(I,50)=ABSC(1)
      GO TO 7503
 7772 IF(NM.NE.15)GO TO 7773
      PLTMAT(I,49)=ABSC(2)
      PLTMAT(I,50)=ABSC(5)
      GO TO 7503
 7773 IF(NM.NE.20)GO TO 7774
      PLTMAT(I,49)=ABSC(3)
      PLTMAT(I,50)=ABSC(1)
      GO TO 7503
 7774 IF(NM.NE.25)GO TO 7503
      PLTMAT(I,49)=ABSC(3)
      PLTMAT(I,50)=ABSC(5)
      GO TO 7503
 7505 CONTINUE
      IF(PLUS.EQ.PLTMAT(I,1))PLTMAT(I,1)=ZERO
      IF(PLUS.EQ.PLTMAT(I,16))PLTMAT(I,16)=ZERO
      IF(PLUS.EQ.PLTMAT(I,17))PLTMAT(I,17)=ZERO
      IF(PLUS.EQ.PLTMAT(I,32))PLTMAT(I,32)=ZERO
      IF(PLUS.EQ.PLTMAT(I,33))PLTMAT(I,33)=ZERO
      IF(PLUS.EQ.PLTMAT(I,48))PLTMAT(I,48)=ZERO
      IF(NM.NE.28)GO TO 7653
      PLTMAT(I,49)=ABSC(3)
      PLTMAT(I,50)=ABSC(6)
      GO TO 7503
 7653 IF(NM.NE.29)GO TO 7654
      PLTMAT(I,49)=ABSC(3)
      PLTMAT(I,50)=ABSC(7)
      GO TO 7503
 7654 IF(NM.NE.30)GO TO 7655
      PLTMAT(I,49)=ABSC(4)
      PLTMAT(I,50)=ABSC(1)
      GO TO 7503
 7655 IF(NM.NE.31)GO TO 7503
      PLTMAT(I,49)=ABSC(4)
      PLTMAT(I,50)=ABSC(2)
 7503 CONTINUE
 7502 NN=NSUM+1
      NBG=1
      NBE=16
      WRITE(6,905)
  905 FORMAT(1H1)
      DO 7300 I=1,NUB
      LI=0
      GO TO(262,263,264,264),NTYPLT
  262 WRITE(6,920)INCH(I),NBLOCK,NBL2,NBL3,NBL4,NTREAT,NTRT2,NTRT3,NTRT4
  920 FORMAT(1HO,37X,3HO -,I3,7H INCHES,7H BLOCKS,4I3,11H TREATMENTS,4I3
     1)
      GO TO 265
  264 NGPS5=0
      IF(NGRP1.NE.0)NGPS5=NGPS5+1
      IF(NGRP2.NE.0)NGPS5=NGPS5+1
      IF(NGRP3.NE.0)NGPS5=NGPS5+1
      IF(NGRP4.NE.0)NGPS5=NGPS5+1
      NTR2=NGRP1*5
      NTR4=NGRP2*5
      NTR6=NGRP3*5
      NTR8=NGRP4*5
      NTR1=NTR2-4
      NTR3=NTR4-4
      NTR5=NTR6-4
      NTR7=NTR8-4
      IF(NTYPLT.EQ.4)GO TO(552,553,554,555),NGPS5
      GO TO(9998,9997,9996,9995),NGPS5
 9998 WRITE(6,924)AINCH(I),NGRP1,(TRCOMB(L),L=NTR1,NTR2)
  924 FORMAT(1HO,42X,A6,14H INCHES  GROUP,I3,1H-,5I3)
      GO TO 265
 9997 WRITE(6,9994)AINCH(I),NGRP1,(TRCOMB(L),L=NTR1,NTR2),NGRP2,(TRCOMB(
     1L),L=NTR3,NTR4)
 9994 FORMAT(1HO,29X,A6,8H INCHES ,2(6H GROUP,I3,1H-,5I3))
      GO TO 265
 9996 WRITE(6,9993)AINCH(I),NGRP1,(TRCOMB(L),L=  NTR1,NTR2),NGRP2,(TRCOM
     1B(L),L=NTR3,NTR4),NGRP3,(TRCOMB(L),L=NTR5,NTR6)
 9993 FORMAT(1HO,17X,A6,8H INCHES ,3(6H GROUP,I3,1H-,5I3))
      GO TO 265
 9995 WRITE(6,9992)AINCH(I),NGRP1,(TRCOMB(L),L=NTR1,NTR2),NGRP2,(TRCOMB(
     1L),L=NTR3,NTR4),NGRP3,(TRCOMB(L),L=NTR5,NTR6),NGRP4,(TRCOMB(L),L=N
     2TR7,NTR8)
 9992 FORMAT(1HO,7X,A6,8H INCHES ,4(6H GROUP,I3,1H-,5I3))
      GO TO 265
  263 WRITE(6,925)AINCH(I),NBLOCK,NBL2,NBL3,NBL4,NTREAT,NTRT2,NTRT3,NTRT
     14
  925 FORMAT(1HO,37X,A6,7H INCHES,7H BLOCKS,4I3,11H TREATMENTS,4I3)
      GO TO 265
  552 WRITE(6,556) INCH(I),NGRP1,(TRCOMB(L),L=NTR1,NTR2)
  556 FORMAT(1HO,42X,3HO -,I3,14H INCHES  GROUP,I3,1H-,5I3)
      GO TO 265
  553 WRITE(6,557)  INCH(I),NGRP1,(TRCOMB(L),L=NTR1,NTR2),NGRP2,(TRCOMB(
     1L),L=NTR3,NTR4)
  557 FORMAT(1HO,29X,3HO -,I3,8H INCHES ,2(6H GROUP,I3,1H-,5I3))
      GO TO 265
  554 WRITE(6,558)  INCH(I),NGRP1,(TRCOMB(L),L=  NTR1,NTR2),NGRP2,(TRCOM
     1B(L),L=NTR3,NTR4),NGRP3,(TRCOMB(L),L=NTR5,NTR6)
  558 FORMAT(1HO,17X,3HO -,I3,8H INCHES ,3(6H GROUP,I3,1H-,5I3))
```

```
      GO TO 265
  555 WRITE(6,559)  INCH(I),NGRP1,(TRCOMB(L),L=NTR1,NTR2),NGRP2,(TRCOMB(
     1L),L=NTR3,NTR4),NGRP3,(TRCOMB(L),L=NTR5,NTR6),NGRP4,(TRCOMB(L),L=N
     2TR7,NTR8)
  559 FORMAT(1HO,7X,3HO -,I3,8H INCHES ,4(6H GROUP,I3,1H-,5I3))
  265 DO 7350 L=NBG,NBE
      LI=LI+1
      WRITE(6,921)INWAT(LI),SCALE(I,LI),(PLTMAT(J,L),J=1,NSUM)
  921 FORMAT(1X,A1,F7.2,123A1)
 7350 CONTINUE
      NBG=NBG+16
      NBE=NBE+16
 7300 CONTINUE
      DO 7776 I=49,50
 7776 WRITE(6,7775)(PLTMAT(J,I),J=1,NSUM)
 7775 FORMAT(9X,123A1)
      WRITE(6,922)(AMO(L),L=NBGMO,NBGMOE)
  922 FORMAT(8X,4(12X,A6,13X))
      IF(NABS.EQ.0)GO TO 7887
      IF(NEND1.EQ.99)CALL EXIT
      IF(NEND1.EQ.9)GO TO 505
      REWIND 2
      REWIND 8
      REWIND 10
      GO TO 6999
 7887 DO 7888 I=1,123
      DO 7888 J=1,50
 7888 PLTMAT(I,J)=BLANK
      DO 95 I=1,123
      PLTMAT(I,1)=PLUS
      PLTMAT(I,16)=PLUS
      PLTMAT(I,17)=PLUS
      PLTMAT(I,32)=PLUS
      PLTMAT(I,33)=PLUS
   95 PLTMAT(I,48)=PLUS
      GO TO 8000
  280 CONTINUE
      LINES=0
      IF(NTYPLT.EQ.4.AND.NRUN.EQ.1)GO TO 460
      IF(KLBR.GT.1)GO TO 8214
      REWIND 8
      DO 222 I=1,12
      AMX(I)=AMX3(I)
  222 AMN(I)=AMN3(I)
      DO 453 I=1,17
      AMX2(I)=0.
      AMN2(I)=99.
  453 CONTINUE
  534 OT(1)=FORM
      OT(2)=FORM1
      KLBR=KLBR+2
      WRITE(6,233)PART(TYPE)
  233 FORMAT(20H1GROUP     TREATMENTS,27X, A5,18H SOIL MOISTURE FOR,28X,4
     1HDATE/23X,81H00-06 06-12 12-18 18-24 24-30 30-36 36-42 42-48 48-54
     2 54-60 60-66 66-72  MO DA YR)
  232 READ(10,9999)NGP,(NT(I),I=1,5),(GRPS(I),I=1,12),MO,ND,NYR,KOD
      IF(KOD.EQ.9)GO TO 237
      NRUN=1
      DO 236 I=1,12
      AC(I)=GRPS(I)
      GRPS(I)=BLKSP
      OT(I+2)=OUTT(2)
      IF(AC(I).EQ.0.)GO TO 236
      GRPS(I)=AC(I)
      OT(I+2)=OUTT(1)
  236 CONTINUE
      IF(LINES.LT.56)GO TO 239
      WRITE(6,233)PART(TYPE)
      LINES=0
  239 CONTINUE
      WRITE(6,OT)NGP,(NT(I),I=1,5),(GRPS(I),I=1,12),MO,ND,NYR
      IF(NGP.NE.N4)GO TO 797
      WRITE(6,9565)
      LINES=LINES+2
      GO TO 232
  797 CONTINUE
      LINES=LINES+1
      GO TO 232
  237 REWIND 10
      IF(NEND.EQ.99)GO TO 460
      IF(NTYPLT.NE.4)GO TO 8214
  460 CONTINUE
      IF(NRUN.GT.1)GO TO 8214
      NRUN=NRUN+1
      LINES=0
      WRITE(6,905)
      WRITE(6,9101)PART1(2),PART(TYPE)
      OUT(1)=FORM2
      OUT(2)=FORM3
  476 READ(12,9999)NGP,(NT(I),I=1,5),(GRPS(I),I=1,24),MO,ND,NYR,KOD
      IF(KOD.EQ.9)GO TO 492
      I3=0
      DO 455 I2=12,24,2
      I3=I3+1
  455 GRPS(I3+10)=GRPS(I2)
      WRITE(8,9999)NGP,(NT(II),II=1,5),(GRPS(L),L=1,17),MO,ND,NYR,KOD
      DO 482 I=1,17
      AC(I)=GRPS(I)
      GRPS(I)=BLKSP
      OUT(I+2)=OUTT(2)
      IF(AC(I).EQ.0.)GO TO 482
      GRPS(I)=AC(I)
      IF(AMX2(I).LT.GRPS(I))AMX2(I)=GRPS(I)
      IF(AMN3(I).EQ.0.)GO TO 473
      IF(AMN2(I).GT.GRPS(I))AMN2(I)=GRPS(I)
      GO TO 478
  473 AMN2(I)=AMN3(I)
  478 CONTINUE
      OUT(I+2)=OUTT(1)
  482 CONTINUE
```

```
      IF(LINES.LT.56)GO TO 471
      WRITE(6,905)
      WRITE(6,9101)PART1(2),PART(TYPE)
      LINES=0
  471 CONTINUE
      WRITE(6,OUT)NGP,(NT(I),I=1,5),(GRPS(I),I=1,17),MO,ND,NYR
      IF(NGP.NE.N4)GO TO 474
      WRITE(6,9565)
      LINES=LINES+2
      GO TO 476
  474 CONTINUE
      LINES=LINES+1
      GO TO 476
  492 CONTINUE
      WRITE(8,9999)NGP,(NT(II),II=1,5),(GRPS(L),L=1,17),MO,ND,NYR,KOD
      REWIND 8
      IF(NEND.EQ.99)CALL EXIT
      DO 494 I=1,17
      AMX(I)=AMX2(I)
  494 AMN(I)=AMN2(I)
      GO TO 8214
  244 READ(10,9999)NGP,(NT(I),I=1,5),(GRPS(I),I=1,12),MO,ND,NYR,KOD
      NI=12
  498 IF(KOD.EQ.9)GO TO 7500
      IF(GROUP(NGP).EQ.0.)GO TO(244,244,244,470),NTYPLT
      DO 245 I=1,NI
  245 AC(I)=GRPS(I)
      IF(NGP.EQ.NGRP1)GO TO 863
      IF(NGP.EQ.NGRP2)GO TO 864
      IF(NGP.EQ.NGRP3)GO TO 865
      IF(NGP.EQ.NGRP4)GO TO 866
      GO TO(244,244,244,470),NTYPLT
  470 CONTINUE
      READ(8,9999)NGP,(NT(I),I=1,5),(GRPS(I),I=1,17),MO,ND,NYR,KOD
      NI=17
      GO TO 498
      END
```

APPENDIX B2 -- Detailed Description of Variables Used in the Source Program Listed in Appendix B1.
Output Variables are not Included.

Symbol	Description of Variables
A15	Remainder from the division BETW/15.
AAS	Alphabetic character A (This character is used as a plotting symbol)
ABSC(I) I = 1,7	A storage vector containing the integers 0, 1, 2, 3, 5, 8 and 9 in alphameric mode.
AC(I) I = 1,17	Soil moisture in inches.
ACC(I) I = 1,17	Total soil moisture in the soil profile for a given block-treatment combination.
AIJL(I,J,k) I = 1,12 J = 1,12 k = k,12	Number of observations per block, treatment and depth combination.
AINCH(I) I = 1,3	Depth interval for which a given soil moisture plotting applies. For example, 06-12 inches or 12-18 inches.
AKARDS	See KARDS in input section.
ALPH(I) I = 1,8	In the initial phase of the program, the data are coded so that they may be properly ordered for analysis of variance. The coding is accomplished by comparing appropriate identification coding from the basic data with an identification dictionary. If no comparison is found, the missing identification code is written on utility unit 08. At the end of the particular group of data in question, all information written on S.SU08 is rewritten on S.SU06. ALPH(I) is the variable used for transferring the data from one unit to another.
AMN(I) I = 1,17	Minimum soil moisture (accumulations by 3" and 6" increments) for the interval I = 1,17.
AMN2(I) I = 1,12	Minimum soil moisture (6" increments) for the intervals I = 1,12.
AMN3(I) I = 1,12	Minimum soil moisture (grouped treatments by six-inch increments) for the intervals I = 1,12.
AMO(I) I = 1,12	Month of year. For example: Jan., Feb. or June.
AMT	Soil moisture for either 3" or 6" increments.
AMX(I) I = 1,17	Maximum soil moisture (accumulation by 3" and 6" increments) for the intervals I = 1,17.
AMX2(I) I = 1,12	Maximum soil moisture (6" increments) for the intervals I = 1,12.
AMX3(I) I = 1,12	Maximum soil moisture (grouped treatments by 6" increments) for intervals I = 1,12.
AMXDEP	See MAXDP1 in the input section.
AN15	N15(.01).
ANGRPS(I,J) I = 1,4 J = 1,12	The number of observations for a given group of treatments and depth combinations.
ANNYR	NNYR converted to floating point arithmetic (leap year computations)
ANSC	NSC converted to floating point arithmetic.
ANSEQ	Sequence number.
ANYR	NYR converted to floating point arithmetic.
ASTER	Special character *. This character is used as a plotting symbol.
AVG	Average soil moisture for a given depth reading.
BEG3	Beginning update code for data written on S.SU01.
BEG4	Beginning sequence number for data written on S.SU01.
BETW	Difference between maximum and minimum soil moisture values.
BLANK	One character alphameric blank space.
BLK3	Three character alphameric blank space.
BLKSP	Six character alphameric blank space.
BOTTOM	Soil moisture increment (either 3" or 6").
BTD(I,J,K) I = 1,12 J = 1,12 K = 1,12	Soil moisture for given block-treatment - depth combination.

CHK(I) I = 1,2	Storage vector containing the alphabetic characters IN and FT. These 2 words indicate the units of depth.
CHKPT(30)	Library subroutine for IBM 7040. Information is written on S.SU03 every 30 minutes to allow restart of the program in the event that machine failure occurs.
CON	Factor for converting percentage soil moisture by volume to inches water.
DIF	Defined as: AC - SCALE
DEPINV(I) I = 1,12	Storage vector containing depth intervals, i.e. 00-06, 06-12.
DIV15	BETW/15
DIVS	BETW is divided into 15 equal increments. DIVS represents one increment.
DPINC(I) I = 1,17	Storage vector containing depth interval for accumulated total soil moisture data, i.e. 3, 6, 9, 12.
END3	Ending update code for data written on S.SU01.
END4	Ending sequence number for data written on S.SU01.
FORM	Variable format.
FORM1	Variable format.
GROUP(I) I = 1,4	Treatment combinations. The soil moisture for different treatments may be combined as group (one value or curve).
I	Variable index used for obtaining correct storage and branching.
II	Variable index.
INCH(I) I = 1,3	Depth interval for which a given soil moisture plotting of accumulated total soil moisture vs time applied. For example: 0"-3" or 0"-24".
INDEX1	Variable index for storage allocation.
INDEX2	Variable index for storage allocation.
INDEX3	Variable index for storage allocation.
INDX	Variable index
INN	Variable index
INWAT(I) I = 1,16	Storage vector containing the ordinate identification.
J	Variable index.
JJ	Variable index.
JJJ	Variable index.
JM	Variable index.
K	Variable index.
KGRPS	Variable index.
KK	Variable index.
KLBR	Variable index.
KOD	A nine code that signifies the end of data on S.SU02 and S.SU10.
L	Variable index.
LGO	Variable index.
LI	Variable index.
LIM	Variable index.
LINES	Number of lines written per page.
LIST	Lines.
LJM	Variable index.
LL	Variable index.
LM	Variable index.
LMI	Variable index.
LMII	Variable index.
LMJ	Variable index.
LMM	Variable index.
LMM	Variable index.
LN	Variable index.

LOM	Variable index.
MARY	Variable index.
MM	Variable index.
MOI	Month
MOB	First month being plotted minus one.
MONTH(I) I = 1,12	Number of days per month.
N	Variable index.
N1	Depth code.
N2	Treatment code.
N3	Block code.
N4	Access tube code.
N15	DIV15(100) converted to fixed point arithmetic.
NABS	Variable index used in branching instructions.
NBE	Variable index used in writing plotting matrix (PLTMAT)
NBEG	Variable index used in branching instructions.
NBG	Variable index used in writing plotting matrix (PLTMAT)
NBGMO	First month to be plotted.
NBGMOE	Last month to be plotted on a given sheet.
NBR	Variable index used in branching instructions.
NCOMP	Depth to which moisture has been accumulated
ND1	Day
NJ	Variable index.
NKL	Variable index.
NL	Variable index.
NLOW	Variable index used to determine the lower limit of write loop.
NM	Variable index.
NN	Variable index.
NNYR	ANYR/4 converted to fixed point arithmetic.
NPLX	X - coordinate point.
NSC	Variable used for converting floating point variables to fixed point variables.
NSEQ	Sequence number.
NSPACE	Defined as: NSPACE = NBLKS * NTRTS
NPLY	Y - coordinate point
NSUM	Accumulated number of days for the months being plotted.
NTIMES	The number of records written on S.SU08.
NTH	Number of 3" or 6" increments between sampling points.
NUB	Number of plottings to be made on a given sheet.
NUUP	Variable index used to locate the upper limit of a write loop.
NW	Inches of water at a given depth as determined from the basic percentage by volume soil moisture data.
NYR1	Year.
ONHAL(I) I = 1,3	One-half of the interval between ordinate scale values for 3 curves I = 1,3.
OT	Variable format specification.
OUT(I) I = 1,20	Variable format specification.
OUTT(I) I = 1,2	Format specifications that are used to develop OUT and OT
PAGE	Sequential page number.
PERD	Special character used to represent a plotting point.
PLTMAT(I,J) I = 1,123 J = 1,50	Plotting matrix.
PLUS	Special character used to represent a plotting point.

SCALE(I,J) I = 1,3 J = 1,16	Ordinate scale for moisture plottings.
STAR	Special character that is used to represent a plotting point.
SUM	Ordinate scale values and accumulated soil moisture by 3" and 6" increments.
SUMGRP(I,J) I = 1,4 J = 1,12	Soil moisture by 6" increments for groupings 1-4 at depths 1-12.
THREE	Number of 3" or 6" increments.
XES	Alphabetic character X used to represent a plotting point.
ZERO	Alphabetic character O used to indicate every fifth division and the end of month on the abscissa scale.

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