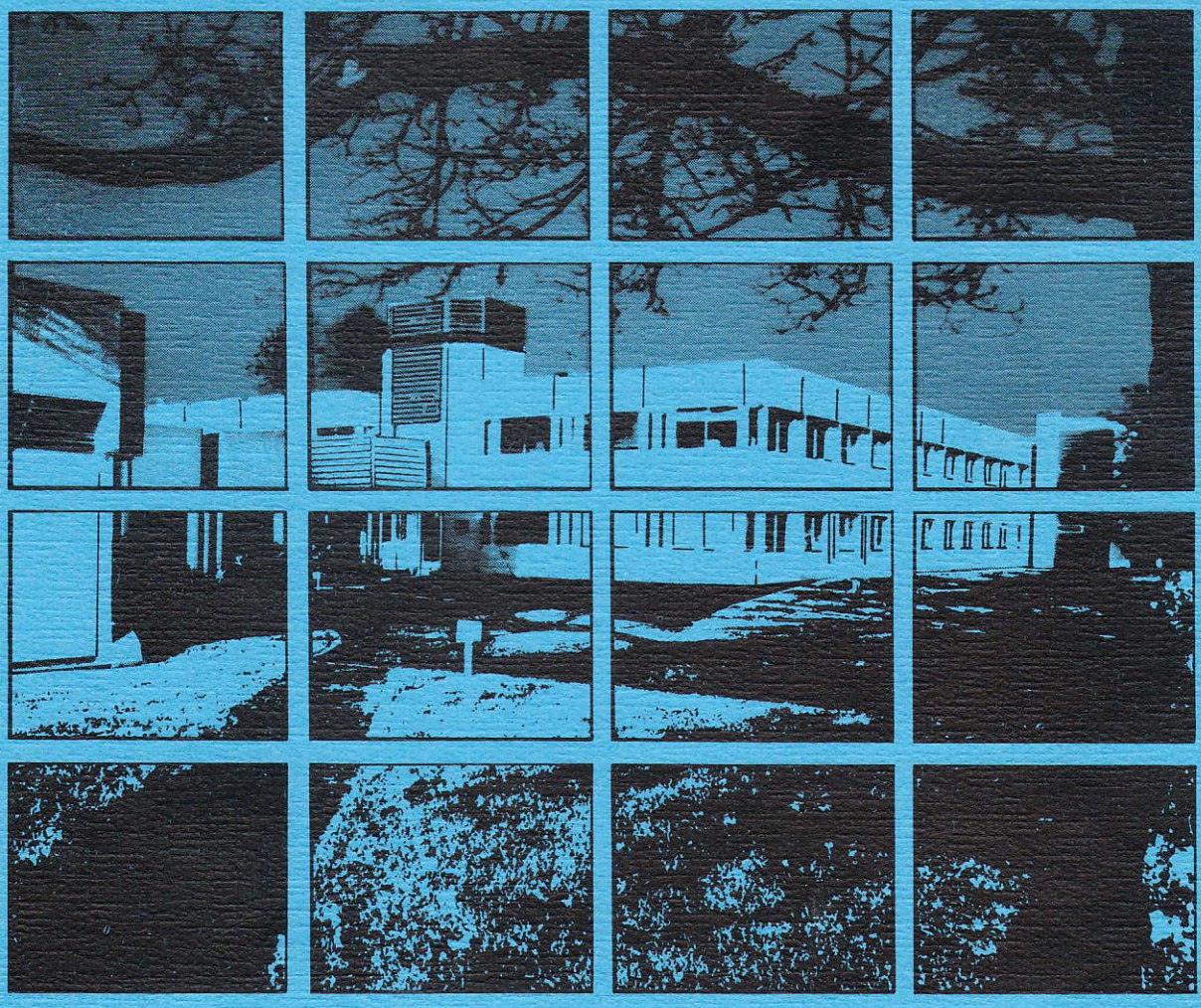
INSTITUTE of HYDROLOGY

The soil moisture databank



Report No 76

INSTITUTE OF HYDROLOGY

THE SOIL MOISTURE DATABANK: MOISTURE CONTENT DATA FROM SOME BRITISH SOILS

by

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ABSTRACT

A data bank of neutron probe soil moisture measurements made at sites throughout Great Britain has been compiled at the Institute for a comparison of measured soil moisture deficits and estimates of soil moisture deficit prepared from meteorological data by the Meteorological Office Rainfall and Evaporation Calculation System (MORECS). This databank may also satisfy the needs of hydrologists and agriculturalists for soil moisture information and the data can be made available to all interested parties on request. The report includes a description of how the soil moisture datasets were collected from the organisations which contributed to the databank. Summaries of the data sets are presented in graphical form with details of the field sites at which they were recorded. In addition, a list of neutron probe users and their interests is given in the hope of encouraging further contacts between those using neutron probes for measuring soil moisture content.

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1. INTRODUCTION

The need for a soil moisture databank

In 1979 the Institute of Hydrology was commissioned by the Department of the Environment, and subsequently by the Ministry of Agriculture, Fisheries and Food, to conduct a project to evaluate the accuracy of soil moisture deficits estimated by MORECS (the Meteorological Office Rainfall and Evaporation Calculation System), by comparing MORECS estimates with measured deficits. It was recognised that an assessment of the reliability of the deficit estimates would require comparisons in many parts of the country over several years for a number of crops and a wide variety of soil types. The soil moisture deficit information available from the Institute of Hydrology's own experimental sites was clearly insufficient for this work as no arable crops and only a few soil types were represented. Therefore, it was necessary to consider using data recorded by other organisations and this led to the setting up of a soil moisture databank at the Institute.

The requirements of the databank

The principal considerations in determining which data were appropriate for inclusion in the databank were that soil moisture records were required for periods of several months to several years, collected on a fairly regular basis. The sites included had, if possible, to represent a variety of crop and soil types and be distributed throughout Great Britain.

Because of the need for records of soil moisture measurements at individual sites over extended periods of time, it was apparent that only measurements made by the neutron probe method (Bell 1976) would be appropriate; this technique enables repeated non-destructive monitoring of soil moisture changes in the field at the same site. The two similar neutron probes designed by the Institute of Hydrology, the Wallingford Probe and the Institute of Hydrology Neutron Probe System IH II, are used almost universally in Great Britain. It was decided to restrict the databank to soil moisture records made using these two types of probe to facilitate data standardisation.

A questionnaire was circulated to all organisations which were believed to be involved in neutron probe work in Britain. A register of those having soil moisture data was made and they were subsequently invited to participate in the project by volunteering data. Many were willing and the distribution of the sites subsequently included in the databank is shown in Figure 1.

It is immediately apparent from Figure 1 that much of the data were collected as part of projects undertaken in lowland England. The majority of the sites were on grassland, a reflection of the preference for conducting soil moisture studies under a permanent crop unhindered by cultivations. Cereals, both winter and spring sown, are next best represented (Table 1). Many soil series are included and Table 2 indicates how well different soil groups are represented.

The length of the soil moisture records received varies considerably, from the few months of the growing seasons of arable crops, to several years. The Institute of Hydrology and a few others were using neutron probes to record soil moisture changes on a regular basis as early as 1966 but the method was not widely or reliably used in Britain until the early 1970s. Thus, with the exception of some Institute of Hydrology data, most of the databank comprises records for the latter

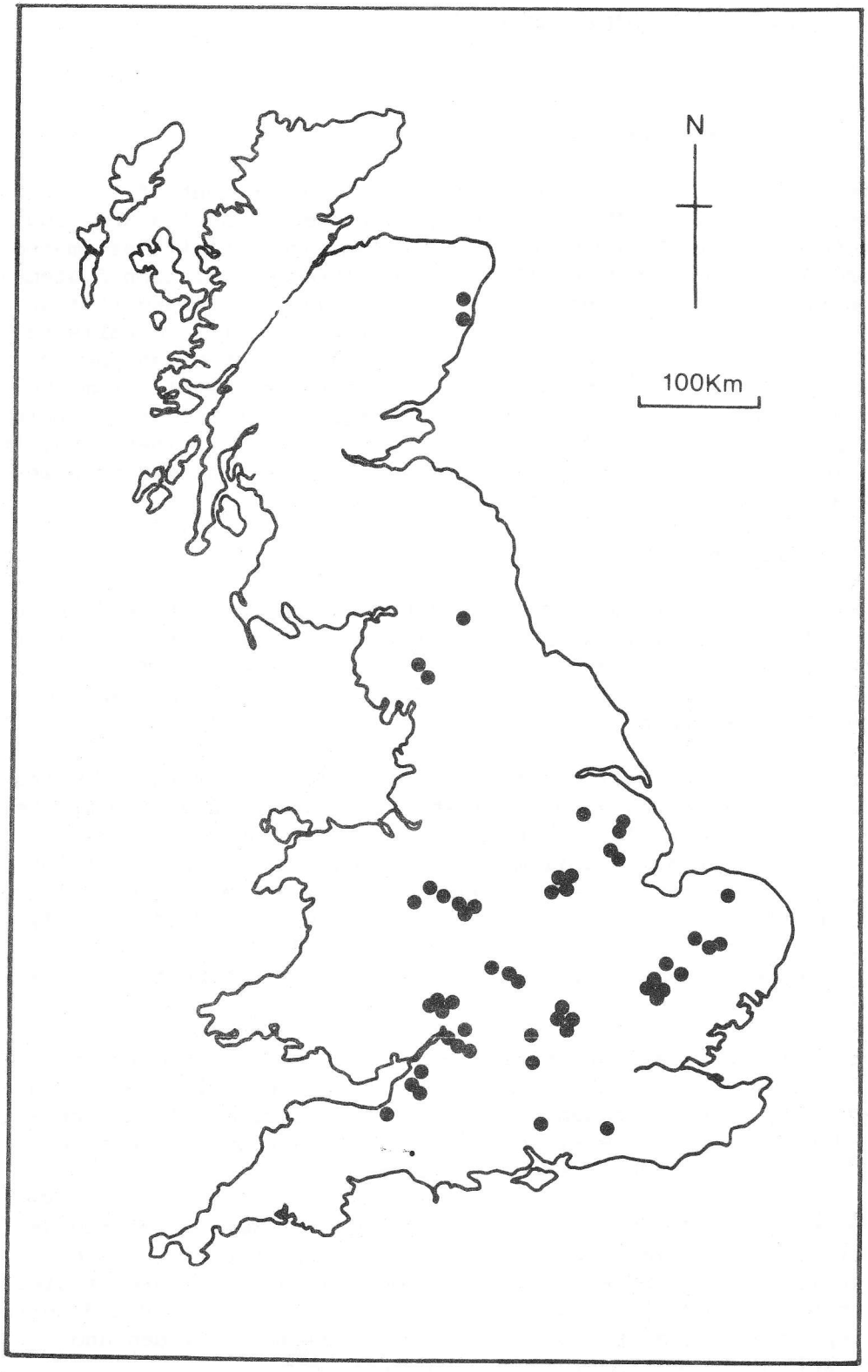


FIGURE 1 The distribution of the soil moisture measurement sites

TABLE 1

Crop type	No. of sites
Permanent pasture	36
Other grassland (eg mown grass)	21
Rough pasture and moorland	11
Cereals	17
Other arable crops	11
Orchard	2
Woodland	6

TABLE 2

Drainage class	Soil group	No. of sites
Well drained	Podzol	5
	Rendzina	8
	Brown calcareous	5
	Brown earth	11
Imperfectly drained	Gleyed brown earth	42
Poorly drained	Surface water gley	25
	Ground water gley	8

part of the 1970s. The most recent datasets extend into the winter of 1979 - 1980. The exceptional drought year of 1976 was recorded at several sites. The frequency of the readings varies considerably; the minimum frequency accepted was monthly, and then only in cases where records continued over several years at one site.

Potential uses for the databank

All of the data in the databank described here may be made available for other projects. It is envisaged that the databank could be useful to agriculturalists and hydrologists in several ways. For example, it will act as a source of information as to the soil moisture regime of many soil series. This is of interest to agricultural advisers advising on drainage and cultivation schemes on given soil series, to agricultural researchers prior to setting up field experiments or wishing to know how changes in soil moisture content at their experimental sites compare with those of other soils, and to hydrologists in indicating the behaviour of the moisture regimes of the soils within catchments. Alternatively, soil moisture data may be required for use in models of, for example, crop water use or groundwater recharge, both at the model development stage, or to test the model independently.

2. OBTAINING THE DATA

The compilation of the databank was carried out in two stages. The first was concerned with contacting organisations known to the Institute of Hydrology as possibly having suitable soil moisture data available, inviting them to volunteer data for the databank and, if they were willing, arranging the data transfer. The second stage (described in the following section) was devoted to the standardising of the data and its storage on the Natural Environment Research Council's UNIVAC 1108 computer.

Register of neutron probe users

The Institute of Hydrology, through its considerable interest in neutron probe work, already had many contacts with researchers in several organisations using this technique. The register of attendants at the meetings of the Neutron Probe Users Group (Bell and McCulloch 1964, 1969), plus a diary of enquiries about neutron probes, provided the basis for a list of organisations which were contacted about the project. To this list were added the addresses of many ADAS (Agricultural Development and Advisory Service) units, Agricultural Research Council research stations, Water Authorities and University and Polytechnic Geography, Agriculture and Civil Engineering Departments. More than 150 questionnaires asking for information about the use of neutron probes were circulated to these organisations. The response was very good (97%) and it was thus possible to prepare an updated register of organisations using neutron probes in Britain (Appendix). All those having neutron probes were invited to participate in the databank project by contributing data. Establishments which intimated a readiness to do so were visited and their work and this project were discussed.

Details of neutron probe use and field sites

Once it was decided that a given dataset could be used, a thorough enquiry was made as to how, where and why it had been recorded. The form reproduced overleaf was completed in the course of acquiring details about access tube installation and use of the probe in the field. Details of the sites, their location, soil and crop were also requested. Whenever possible a visit was made to the sites, preferably with the researcher involved though as some sites had been abandoned it was only possible to view their general setting in the field. The setting of those which could not be visited was discussed in relation to the appropriate topographic map and any photographs that were available. Usually some information about the soils concerned was available but where there was none, the site was re-sampled by auger and the soil tentatively assigned to a soil series. The majority of the sites considered were grassland and a note was made of how it was managed. At arable sites, information concerning sowing and harvesting dates and how cultivation around the access tubes was achieved, was collected if available. A summary of this information for each site or group of sites is given in Section 6.

The reason for conducting the neutron probe work was also discussed to provide a background to the data and an insight as to why the given site was chosen and certain techniques used. However, this information is not very relevant to the databank and so only a brief indication is given in Section 6. In addition the data collector was asked whether he was willing for his data to be used for purposes other than that of the MORECS project. The replies were later confirmed by a written statement. Only those sets of data which the donor specified could be made generally available are included in this published databank.

USE OF PROBE/DATA SUMMARY

DATA COLLECTOR(S) _____ No. _____

TYPE OF PROBE:
RATEMETER/SCALER:
TYPE OF ACCESS TUBES:
OUTER DIAMETER:
WALL THICKNESS:

INSTALLATION OF TUBES:

STANDARD COUNTS (MODERATOR, FREQUENCY, TIME)

CALIBRATION

CALIBRATION FOR SURFACE MEASUREMENTS

FORM OF DATA (RAW, CONVERTED, WRITTEN, CARDS, TAPE)

Data transfer

The system for processing and storing neutron probe data on the NERC Univac 1108 was developed by G Roberts (1981). It was decided to use this established system for the databank as it was well tried and flexible in terms of the subsequent utilisation of data. It handles neutron counts initially and using a given calibration equation converts them to values of volumetric moisture content. Thus copies of the unprocessed neutron count data for each site were requested from the data owners.

3. DATA STANDARDISATION

It was found that all but one of the datasets considered had been collected using ratescaler attachments with Wallingford and Institute of Hydrology probes. The ratescaler provides a digital display of the neutron count rate per second averaged over a given time period; a 16 second period was usually adopted. (Previously a ratemeter was sold which displayed the count rate less accurately on a meter, in analogue form). All the access tubes were of standard aluminium alloy, 1¾" (44.45 mm) external diameter, and 16 s.w.g. wall thickness, as recommended by Bell (1976) for neutron probe work. Many of the other recommendations given by Bell had also been followed. Thus the methods used in the field to collect the data are fairly uniform throughout the databank. However a regular record of a standard water count was not always maintained and several different approaches to calibration were used. As discussed below, these were standardised for the purposes of the databank.

It was also necessary to standardise the format of the different datasets to make them compatible with the neutron probe data processing and storage system at the Institute. A certain amount of simplification was required for some sets so that, for example, data for access tubes in irrigated plots were excluded and means were calculated for groups of replicate data. For those sites where this was necessary, the simplifications are described in Section 6.

Calibration

There has been a prolonged debate in the literature about the calibration of neutron probes for soil moisture work and a variety of methods have been advocated. These include the theoretical derivation of calibrations (eg Olgaard, 1965; Couchat et al., 1975), laboratory calibrations prepared using standard media, or samples of field soils (eg Douglas, 1966) and field calibration procedures (eg Holmes, 1956; Long and French, 1967; Bell, 1976). Whatever means of calibration is adopted, it is absolutely essential that it be carried out with extreme experimental care and rigour. If not, the resultant curve can be less accurate than a standard published curve for the appropriate soil type. Because neutron probes are generally used to indicate moisture content change over time rather than to measure absolute moisture content and because a linear relationship between neutron counts and moisture content is assumed, it is only the gradient of the calibration line that is important. Consequently it is possible to use calibrations determined for similar soils elsewhere with little loss of accuracy. The Institute of Hydrology has determined calibration equations for three categories of soil grouped according to their dominant texture as follows:

Clay soils	MVF =	$0.958\ R/R_w - 0.012$
Loams	MVF =	$0.867\ R/R_w - 0.016$
Silt, sand, gravel and chalk soils	MVF =	$0.790 - 0.024$

MVF = Moisture volume fraction

R = Neutron count rate in soil

R_w = Count rate in water standard

While many of the neutron probe users had conducted a field calibration, several had opted to use one of the Institute calibrations listed above to save the time and effort required for the field method. The neutron probe work undertaken by the regional ADAS centres is calibrated using a laboratory determined calibration for individual probes. In view of the many different calibrations presented with the neutron probe data, it was decided to use the Institute calibration equations for all the data for the purpose of the MORECS project. For some sites this has resulted in differences between the original estimates of water content and those computed for the databank but for most the Institute calibrations were probably as suitable. The original calibration equations are available and when accessing soil moisture data from the databank these may be substituted if preferred.

Surface calibration

A problem arises with the neutron probe method of soil moisture measurement when it is used to monitor soil moisture in the upper 20 cm to 30 cm of the profile. If the normal calibration curve is applied in this zone an erroneous measure of soil moisture content is often obtained due to the escape of neutrons out of the soil; the soil is usually wetter than the measurement suggests. There are several methods to overcome this, including placing a tray of soil over the access tube to remove the air/soil interface while taking readings in the field, establishing a separate calibration for the surface readings, and using adjustments as suggested, for example by Grant (1975), to modify the surface readings. Field determined calibrations for surface readings had been used most frequently with the datasets. The other methods had been applied to a few sets and for some the surface effect had been ignored.

In most soil profiles the largest and most frequent variations of moisture content occur in the upper 30 cm. This zone is therefore very important in determining soil moisture deficits during spring when the remainder of the profile has not dried out appreciably, and, at the end of the summer when the upper part of the profile is initially wetted up. Consequently in the context of the MORECS SMD project it was very important to obtain a good representation of moisture changes in the surface zone. After several approaches to this had been considered, the following method was adopted. For those sites where surface calibration information was available, the factor by which the surface calibration increased the moisture content of the surface readings over that which would have been obtained if the normal calibration had been used, was calculated. The value of the surface readings were modified by the same factor and then processed in the usual way using the appropriate Institute calibration. If no calibration information was available, data for depths of less than 15 cm were deleted and the reading at the next depth was assumed to apply to the whole of the zone above. This latter strategy was adopted in the absence of a simple alternative procedure.

Standard water count

As a neutron probe ages there is inevitably a gradual decrease in the activity of the source and also in the detector's sensitivity to neutrons. Also, every probe has a different count rate. It is recommended therefore that regular "standard counts" in a water standard are determined and used to normalise the count rates measured in the soil, ie the count rate in soil is divided by the standard count rate (Bell, 1976). Using this ratio in calibration equations obviates the need to perform subsequent calibrations as the probe ages, or after repairs, and allows the same calibration to be applied to every probe (assuming the same source/detector geometry and specification).

Among the neutron probe users who provided data it was found that often, because the standard count in water changed little, a practice of making regular standard counts had not been adopted. More usually a record of counts made while the probe was in its shield was maintained and used as a reference. However shield counts are much more variable than standard water counts as they are influenced by temperature and proximity to other moderating materials (eg the soil, the laboratory floor or the operators legs). Shield counts are therefore inadmissible as standard counts.

Where regular standard water counts were available they were used with the corresponding data sets. Where counts had only been performed on an intermittent basis, if the probe user could report that there had been no significant trends or abrupt changes in the shield count, a mean standard water count value was used. While for many probes the annual drift in count rate is generally small, this is not always so. In the absence of data to the contrary it had to be assumed that the drift was negligible.

4. ACCESSING DATA FROM THE DATABANK

All of the datasets have been processed and stored as neutron counts in direct access files on the UNIVAC 1108. In addition copies of the original datasets have been preserved in files on computer tapes. A database for storing profile moisture content data for each site was also set up for the use of the MORECS SMD project. Thus, depending upon requirements, copies of the soil moisture data may be obtained in several forms as follows.

Count rates for each measuring depth:

1. Original dataset
2. Standardised data ie standardised as described for each site in Section 6.

Processed data (Processed using the original calibrations and/or the IH calibrations)

1. Moisture volume fraction (MVF) for each measuring depth
2. Moisture content values for each layer in a profile
3. Total profile moisture content
4. Moisture content of a specific depth of profile

Copies of the soil moisture information may be transferred to other users in the form of files on computer tapes or as computer printout (either listings or graphs).

Applications for data should be made to the Institute of Hydrology at Wallingford. While there will be no charge for the data, costs for handling the data will be recoverable and individual quotations will be given in response to specific requests.

5. SUMMARY OF THE DATA

In the following pages the data in the databank are summarised in the form of graphs of soil profile water content against time. Tables 3 and 4 provide a guide to the databank and may be used to find whether given soil or crop types are represented. Similarly Figures 2 and 3 indicate the location of the sites.

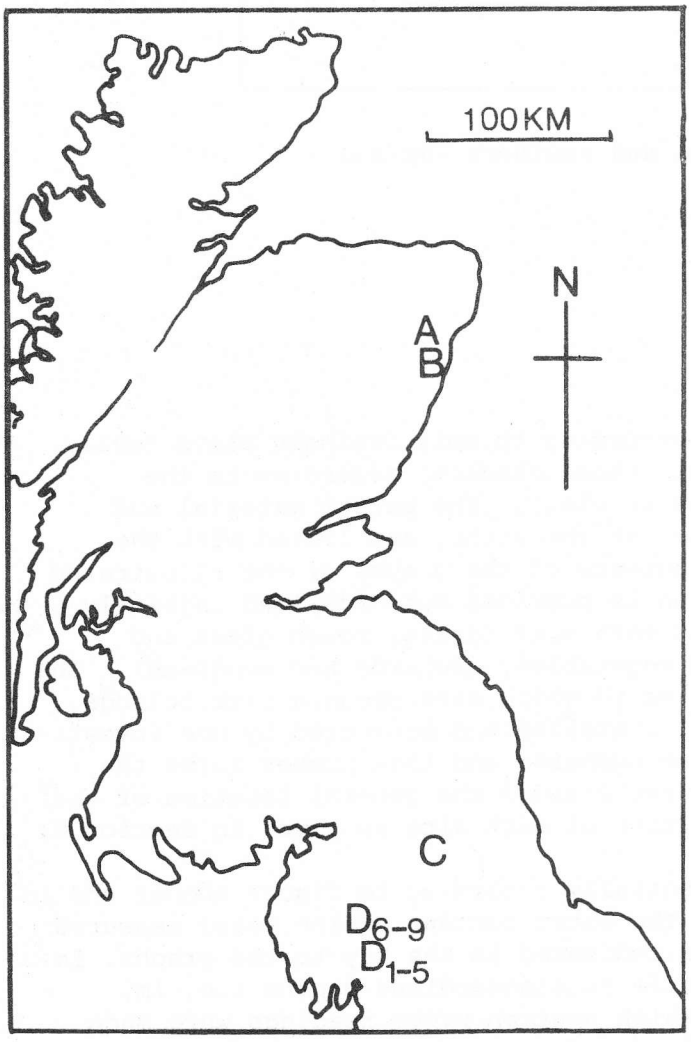


FIGURE 2

Site codes of sites in northern England and Scotland

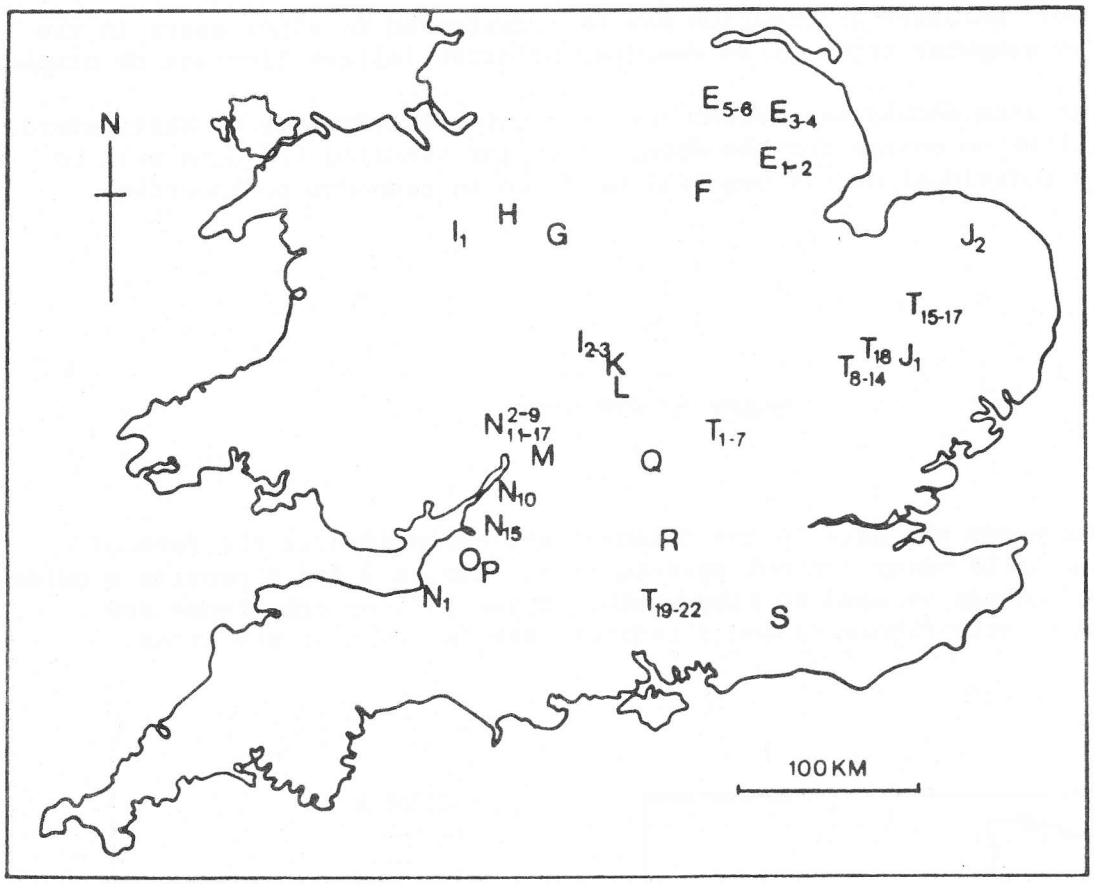


FIGURE 3 Site codes of sites in central and southern England

In Table 3 the sites have been arranged according to soil drainage class (well, imperfectly or poorly drained), and within those classes, according to the dominant texture of the soils (sand, loam or clay). The parent material and series names of the soils, and the landuse at the sites, are listed with the corresponding site codes and the figure numbers of the graphs of the illustrated examples. In Table 4 the same information is provided but organised initially on the basis of the type of crop cover at each site (grass, rough grass and heather, cereals, other arable crops and vegetables, orchards and woodland). The alphabetic part of the site codes indicates to which site group a site belongs. One group represents sites which were all installed and monitored by one investigator. Within each site group the sites are numbered and this number forms the numerical part of the site code. In Figures 2 and 3 the general location of the site groups are shown but the actual position of each site is given in Section 6.

The time series graphs are arranged sequentially according to figure number and in the same order as the sites in Table 3. The water content of the total measured profile is plotted. The depth of this is indicated in the key to the graphs. In addition the moisture content of the profile to standardised depths i.e. 1m, 2m and 3m, are shown for these sites at which neutron probe readings were made to sufficient depth.

TABLE 3

Texture	Soil type	Parent material	Soil series	Land use	Site code	Fig. No:
DRAINAGE CLASS : WELL DRAINED						
Sand	Podzol	Bunter sandstone	Crannymoor	Mown grass	F9	4
				Coniferous wood	F10	5
		Granitic till	Countesswells	Grass	B1	6a
				Bare soil	B2	6b
				Spring barley	B4	6c
				Spring barley	B5, B6, B7, B8	-
	Brown earth	Silurian slates, shales and grits	Brantwood Association	Rough grass	D4	7
		Triassic sandstone and marl	North Newton	Permanent pasture	N8	8
		Triassic sandstone and marl	Bromsgrove	Permanent pasture	N9	9
		Weald and Portland sand and clays	Quainton Hill	Permanent pasture	T7	10
		Terrace sands and gravels	Newport	Permanent) pasture)	G2	11
					G3	12
				Mown grass	G4	13
		Terrace sands and gravels	Wick	Grass	L1	14
				Potatoes	L2	-
Loam	Rendzina	Jurassic limestone	Sherborne	Arable	E5	15
				Arable	E6	16
		Chalk	Andover	Permanent) pasture)	E3	17
					E4	18
				Mown grass	T19	19
				Spring barley	T21	20a
				Spring barley	T22	20b
		Chalk-sand drift	Newmarket - Methwold	Coniferous wood	T16	21
	Brown earth	Triassic marl and sandstone	Greinton	Apple orchard	P1	22
				Apple orchard	P2, P3, P4	-
				Apple orchard	P5	23
				Apple orchard	P6, P7, P8	-
		Drift and Triassic marl	Twickenham	Apple orchard	O1	24
	Brown calcareous	Shallow chalky drift over Chalk	Swaffham - Prior Complex	Permanent) pasture)	T9	25
					T10	26
				Mown grass	T18	27
		Chalk-sand drift	Worlington	Coniferous wood	T15	28
				Grass	T17	29
DRAINAGE CLASS : IMPERFECTLY DRAINED						
Sand	Gleyed brown earth	Calcareous grits	Kington	Mixed wood	Q8	30
				Mixed wood	Q9	-
		Terrace sands	Arrow	Broad beans	K1	31a
				Broad beans	K2	31b
				Broad beans	K3	31c
				Cabbage	K4	32a
				Leek	K5	32b
				Red beet	K6	32c
		Sandy, gravelly alluvium and colluvium	Ollerton Complex	Mown grass	F1	33
				Permanent pasture	F2	34

Texture	Soil type	Parent material	Soil series	Land use	Site code	Fig. No.
Loam	Gleyed brown earth	Keuper Waterstones (marls, silts and sandstones)	Hodnet	Grass	F5	35
				Grass	F6	36
				Woodland	F8	37
		Drift of Triassic origin	Salwick	Mown grass	H3	38
					H4	-
		Drift over Keuper marl	Whimple	Permanent pasture	N2	39
					N3	40
				Winter wheat	N11	41a
		Terrace drift from Keuper Marl	Rushwick	Winter wheat	N14	41b
		Chalky drift	Moulton or Ashley	Sugar beet	J1	42b
		Brick earth	Wickmere	Cabbage	J2	42c
		Sandy clay drift	Brantwood Association	Rough grass	D1	43
		Sandy clay drift	Rivington Association	Heather Moor	D6	44
		Drift or terrace deposits	Langford or Taunton	Grass	N1	42a
		Terrace drift	Isle Abbots	Permanent pasture	M2	45
Clay	Gleyed brown earths	Keuper marl	Worcester	Permanent pasture	N4	46
					N5	47
				Winter wheat	N12	48a
		Drift over Keuper Marl	Dunnington Heath	Winter wheat	N13	48b
		Oxford clay	Evesham	Mown grass	T1	49
				Permanent pasture	T2	-
				Winter wheat	Q1	50
				Winter wheat	Q2	-
				Permanent pasture	Q3	51
					Q4	52
					Q5	-
				Spring barley	Q6	53
				Spring barley	Q7	-
				Temporary grass	I2	54
				Temporary grass	I3	-
		Clayey drift	Podimore	Permanent pasture	M1	55
					M3	56
					M4	57
		Clayey alluvium	Butleigh	Mown grass	M6	58
DRAINAGE CLASS : POORLY DRAINED						
Sand	Groundwater gley	Alluvium of Triassic origin	Compton	Permanent pasture	N6	59
					N7	60
		Alluvium of Bunter sandstone origin	Ollerton Complex	Permanent pasture	F3	61
					F4	62
					F7	63
Loam	Surface water gley	Drift	Pitmedden	Spring barley	A2	64
				Spring barley	A1, A3, A4	-
		Sandy clay drift	Belmont-Wilcox Complex	Heather moor	C2	65
				Heather moor	C1	-
		Sandy clay drift	Brantwood Association	Rough grass	D2, D3, D5	66
		Sandy clay drift	Rivington Association	Heather moor	D7, D8, D9	67
		Drift of Triassic origin	Clifton	Mown grass	G1	68
				Mown grass	H1	69
				Mown grass	H2	-

Texture	Soil type	Parent material	Soil series	Land use	Site code	Fig. No.
	Ground-water gley	Fen alluvium	Downholland	Arable	E1	70
		Fen alluvium	Romney	Arable	E2	71
Clay	Surface water gley	Silurian/ Ordovician shale and mudstone	Speller	Grass	N10	72
		Lias mudstone	Longload	Permanent pasture	M5	73a
				Grass ley	N16	73b
		Oxford clay	Denchworth	Mown grass	T3	74a
				Grass	T4	74b
				Winter oats	R1, R2	75
		Shallow drift	Rowsham	Permanent pasture	T5 T6	76a 76b
		Drift of Triassic origin	Crewe	Permanent pasture	I1	77b
		Drift over Wealden clay	Hildenborough	Winter wheat	S1	77a
				Winter wheat	S2	-
		Clayey drift on chalk	Hanslope	Permanent pasture	T11 T12 T13 T14	78 79 80 81
	Ground-water gley	Clayey alluvium	Rib	Permanent pasture	T8	82

TABLE 4

Texture	Soil type	Parent material	Soil series	Site code	Fig. no:
WELL DRAINED GRASSLAND					
Sand	Podzol	Bunter sandstone	Crannymoor	F9	4
		Granitic till	Countesswells	B1	6a
		Triassic sand-stone and marl	North Newton	N8	8
			Bromsgrove	N9	10
		Weald and Port-land sands and clays	Quainton Hill	T7	10
		Terrace sands and gravels	Newport	G2 G3 G4	11 12 13
			Wick	L1	14
Loam	Rendzina	Chalk	Andover	E3 E4 T19	17 18 19
	Brown calcareous	Shallow chalky drift over chalk	Swaffham-Prior Complex	T9 T10	25 26
		Chalk-sand drift	Worlington	T17	29

Texture	Soil type	Parent material	Soil series	Site code	Fig. No.
GRASSLAND : IMPERFECTLY DRAINED					
Sand	Gleyed brown earth	Sandy gravel alluvium and colluvium	Ollerton Complex	F1 F2	33 34
Loam	Gleyed brown earth	Keuper water-stones (marls, silts and sandstones)	Hodnet	F5 F6	35 36
		Drift of Triassic origin	Salwick	H3	38
		Drift over Keuper marl	Whimple	N2 N3	39 40
		Drift over terrace deposits	Langford or Taunton	N1	42a
		Terrace drift	Isle Abbots	M2	45
Clay	Gleyed brown earths	Keuper Marl	Worcester	N4	46
		Oxford Clay	Evesham	T1 T2 Q3 Q4 Q5 I2 I3	49 - 51 52 - 54 -
		Clayey drift	Podimore	M1 M3 M4	55 56 57
		Clayey alluvium	Butleigh	M6	58
GRASSLAND : POORLY DRAINED					
Sand	Ground-water gley	Alluvium or Triassic origin	Compton	N6	59
		Alluvium of Bunter sandstone origin	Ollerton Complex	F3 F4 F7	61 62 63
Loam	Surface water gley	Drift of Triassic origin	Clifton	G1 H1 H2	68 69 -
Clay	Surface water gley	Silurian/ Ordovician shale and mudstone	Speller	N10	72
		Lias mudstone	Longload	M5 N16	73a 73b
		Oxford clay	Denchworth	T3 T4	74a 74b
		Shallow drift over Oxford clay	Rowsham	T5 T6	76a 76b
		Drift of Triassic origin	Crewe	I1	77b
		Clayey drift over chalk	Hanslope	T11 T12 T13 T14	78 79 80 81
	Ground-water gley	Clayey alluvium	Rib	T8	82
ROUGH UPLAND GRASS					
Sand	Brown earth	Silurian slates, shales and grits	Brantwood Association	D4	7

Texture	Soil type	Parent material	Soil series	Site code	Fig. No.
Loam	Gleyed brown earth	Sandy clay drift	Brantwood Association	D1	43
	Surface water gley	Sandy clay drift	Brantwood Association	D2 D3, D5	66 -
HEATHER MOOR					
Loam	Gleyed brown earth	Sandy clay drift	Rivington Association	D6	44
	Surface water gley	Sandy clay drift	Belmont-Wilcox Complex	C2	65
			Rivington Association	D7, D8, D9	67
CEREALS :					
WINTER WHEAT					
Loam	Gleyed brown earth	Drift over Keuper marl	Whimple	N11	41a
		Terrace drift from Keuper marl	Rushwick	N14	41b
Clay	Gleyed brown earth	Keuper marl	Worcester	N12	48a
		Drift over Keuper marl	Dunnington Heath	N13	48b
		Oxford clay	Evesham	Q1	50
		Drift over Wealdon clay	Hildenborough	S1 S2	77a -
WINTER OATS					
Clay	Surface water gley	Oxford clay	Denchworth	R1	75
SPRING BARLEY					
Sand	Podzol	Granitic till	Countesswells	B4	6c
Loam	Rendzina	Chalk	Andover	T21 T22	20a 20b
Clay	Gleyed brown earths	Oxford clay	Evesham	Q6 Q7	53 -
Loam	Surface water gley	Drift	Pitmedden	A2 A1, A3, A4	64 -
MIXED ARABLE: LEY/POTATOES					
Loam	Rendzina	Jurassic	Sherborne	E5	15
WHEAT/PEAS/ARABLE					
Loam	Rendzina	Limestone	Sherborne	E6	16
WHEAT/PEAS					
Loam	Ground-water gley	Fen alluvium	Downholland	E1	70
WHEAT/SUGARBEET					
Loam	Ground-water gley	Fen alluvium	Romney	E2	71

Texture	Soil type	Parent material	Soil series	Site code	Fig. No.
BROAD BEANS					
Sand	Gleyed brown earth	Terrace sands	Arrow	K1 K2 K3	31a 31b 31c
CABBAGE					
Loam	Gleyed brown earth	Terrace sands	Arrow	K4	32a
		Brick earth	Wickmere	J2	42c
LEEK					
Sand	Gleyed brown earth	Terrace sands	Arrow	K5	32b
REDBEET					
	Gleyed brown earth	Terrace sands	Arrow	K6	32c
SUGAR BEET					
Sand	Gleyed brown earth	Chalky drift	Moulton or Ashley	J1	42b
APPLE ORCHARD					
Loam	Brown earth	Triassic marl and sandstone	Greinton	P1 P2, P3, P4	22 -
		Drift and Triassic marl	Tickenham	O1	24
		Triassic marl and sandstone	Greinton	P5 P6, P7, P8	23 -
CONIFEROUS WOOD					
Sand	Podzol	Bunter sandstone	Crannymoor	F10	5
Loam	Rendzina	Chalk-sand drift	Newmarket-Methwold	T16	21
	Brown calcareous	Chalk-sand drift	Worlington	T15	28
MIXED WOOD					
Sand	Gleyed brown earth	Calcareous grits	Kington	Q9	30
Loam	Gleyed Brown earth	Keuper water-stones (marls, silts and sandstones)	Hodnet	F8	37

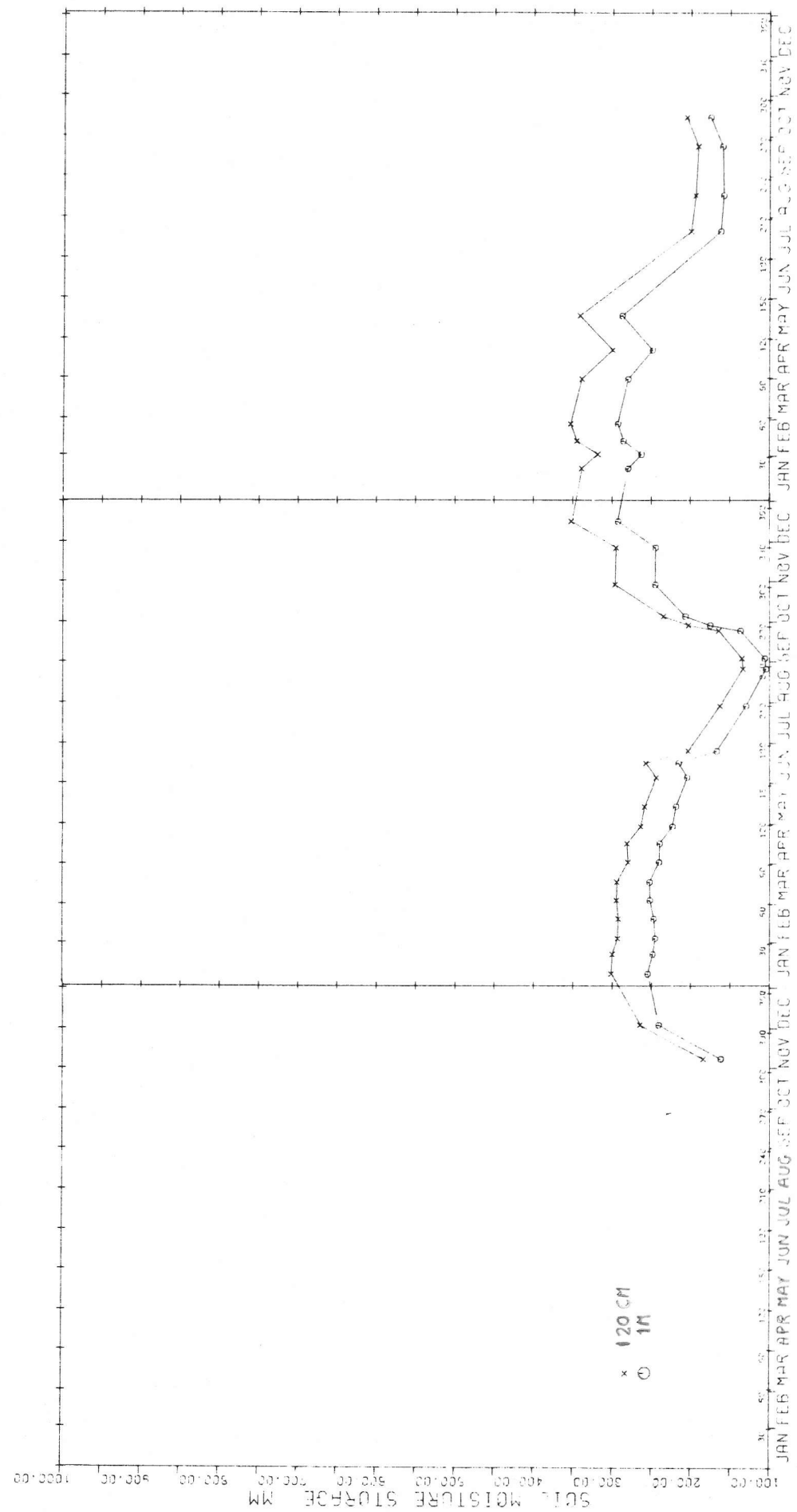


FIGURE 4

Site: F9 **PM Texture:** SANDSTONE **Soil:** PODZOL (CRANNYMOOR) **Landuse:** MOWN GRASS

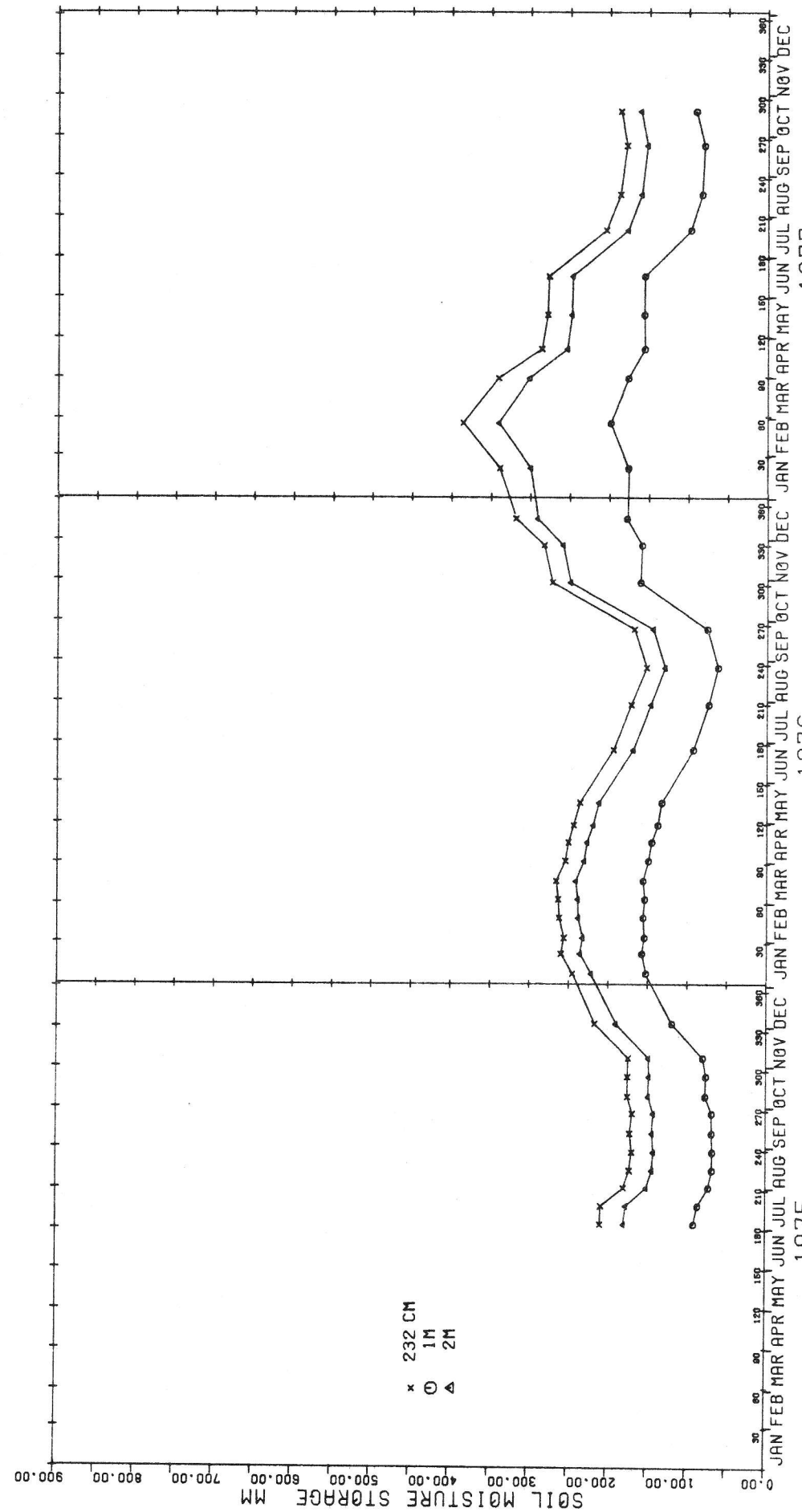


FIGURE 5

Site: F10 PM Texture: SANDSTONE Soil: PODZOL (CRANNYMOOR) Landuse: CONIFEROUS WOOD

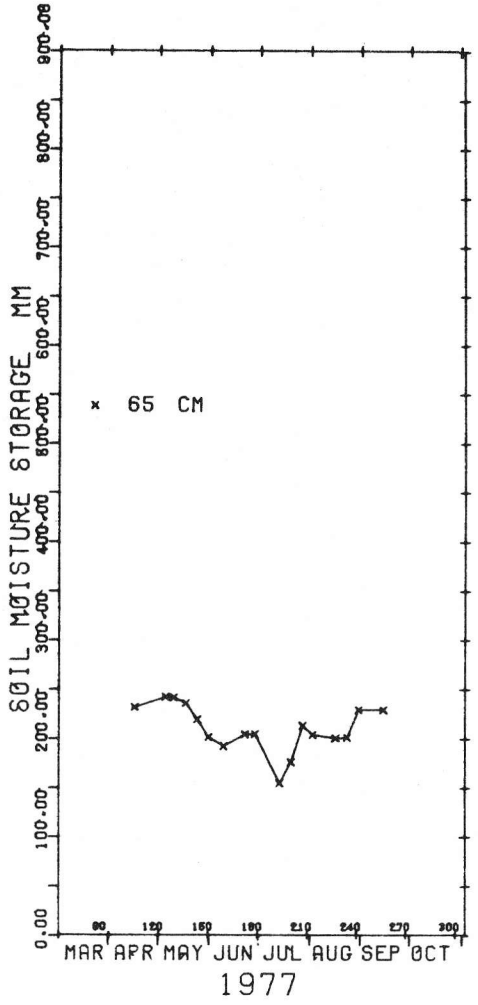


FIGURE 6a

Site: B1
PM Texture: SANDY DRIFT
Soil: PODZOL (COUNTESSWELLS)
Landuse: GRASS

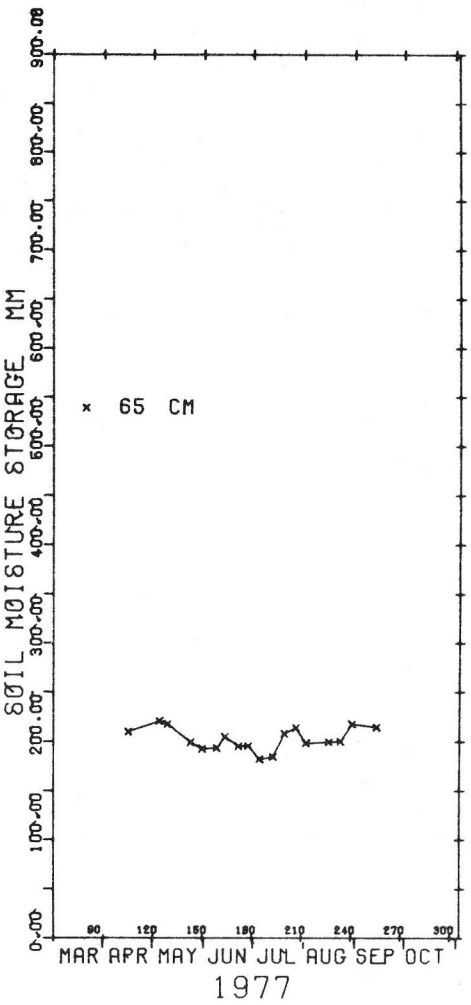


FIGURE 6b

Site: B2
PM Texture: SANDY DRIFT
Soil: PODZOL (COUNTESSWELLS)
Landuse: BARE SOIL

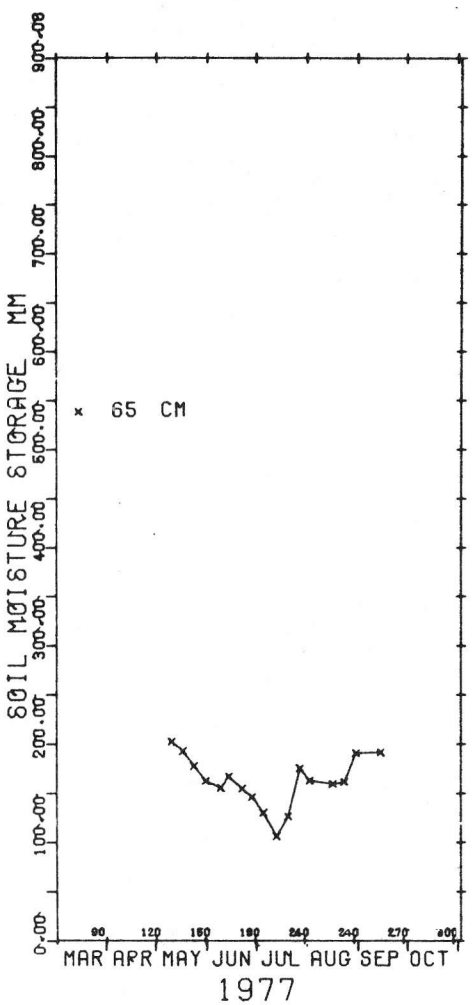


FIGURE 6c

Site: B4
PM Texture: SANDY DRIFT
Soil: PODZOL (COUNTESSWELLS)
Landuse: SPRING BARLEY

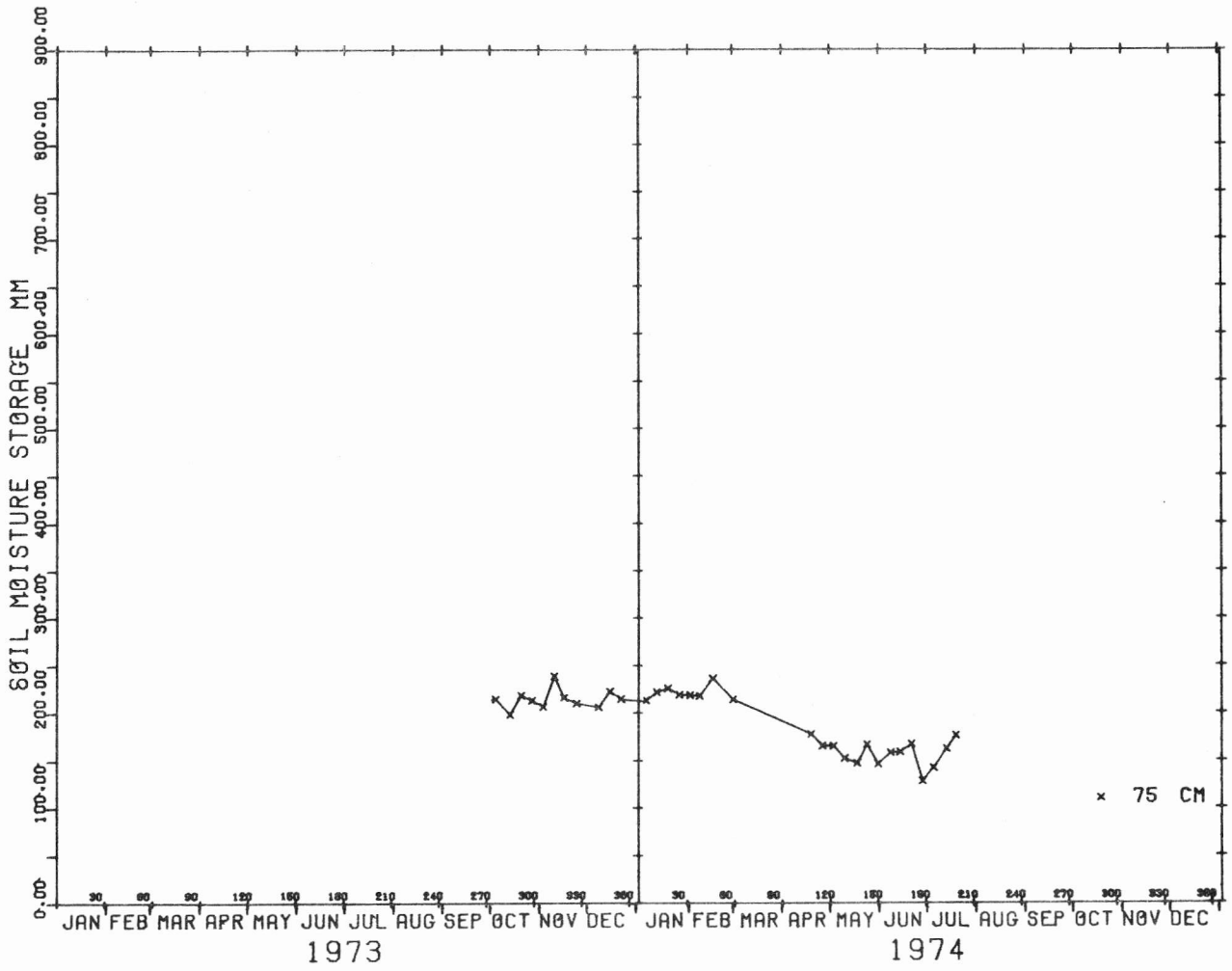


FIGURE 7

Site: D4 PM Texture: SANDY Soil: BROWN EARTH (BRANTWOOD ASSOCIATION) Landuse: ROUGH GRAZING

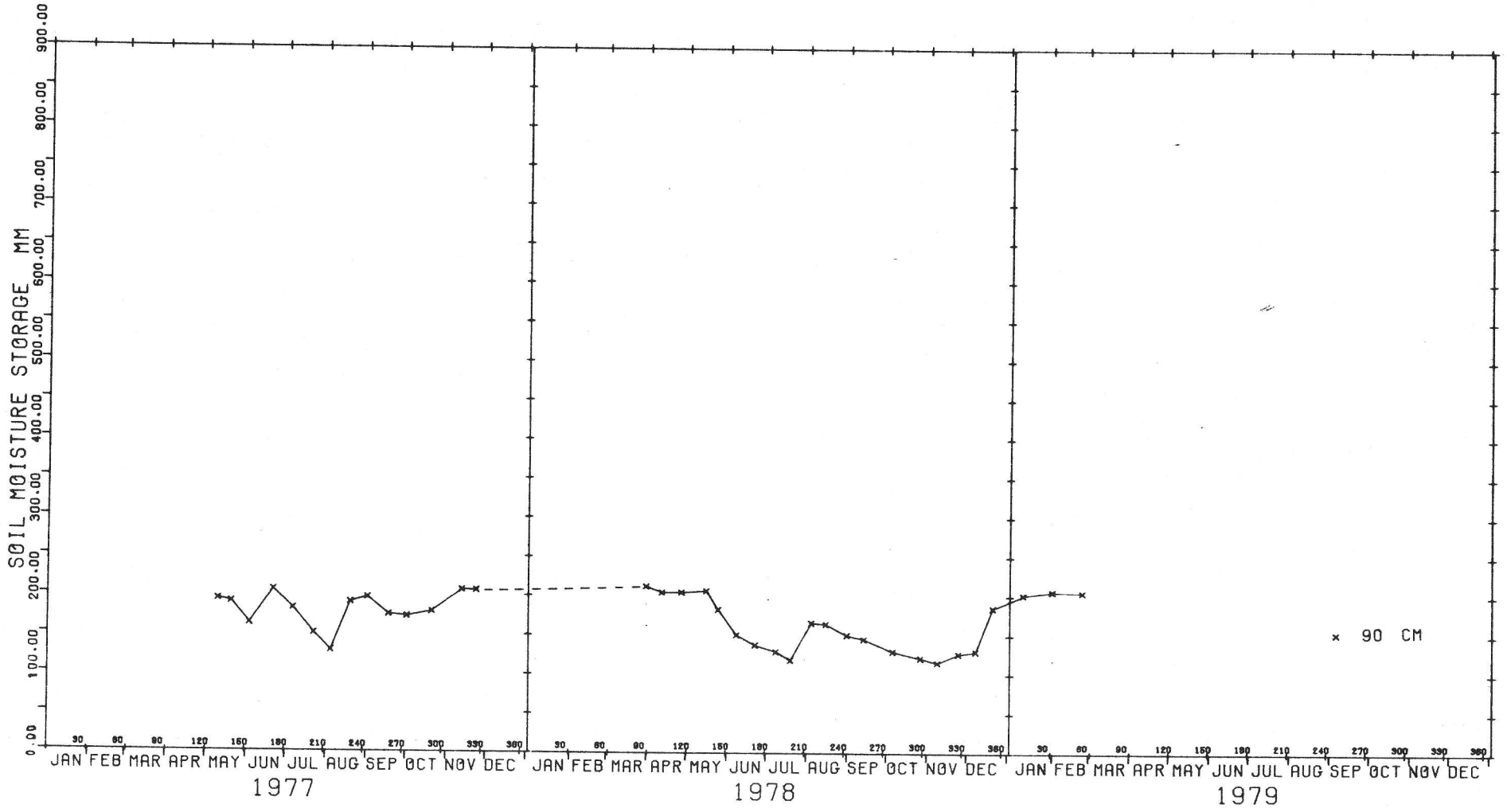


FIGURE 8

Site: N8 PM Texture: LOAMY MARL Soil: BROWN EARTH (NORTH NEWTON) Landuse: PERMANENT PASTURE

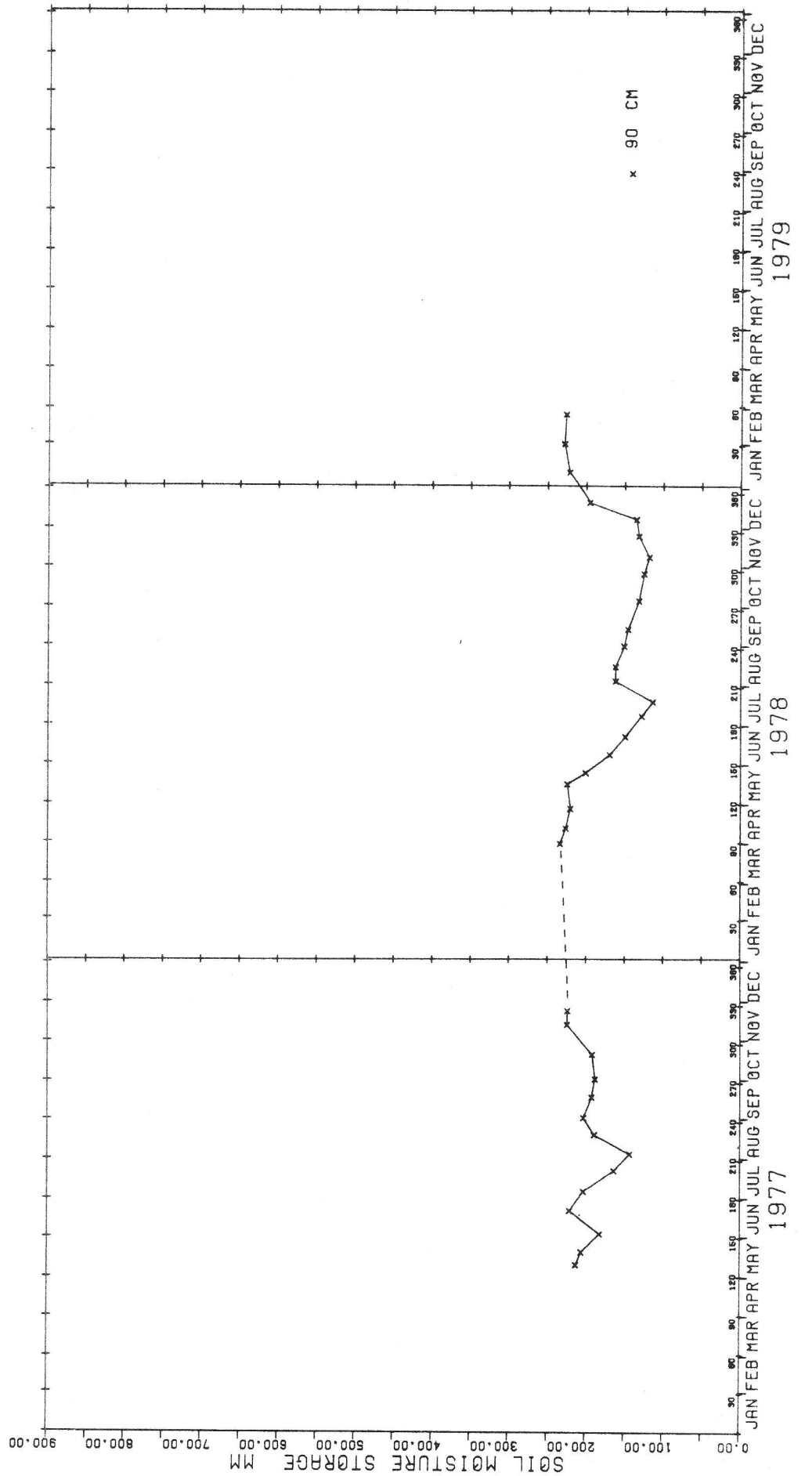


FIGURE 9

Site: N9 PM Texture: SANDSTONE AND MARL, LOAMY Soil: BROWN EARTH Landuse: PERMANENT PASTURE (BROMSGROVE)

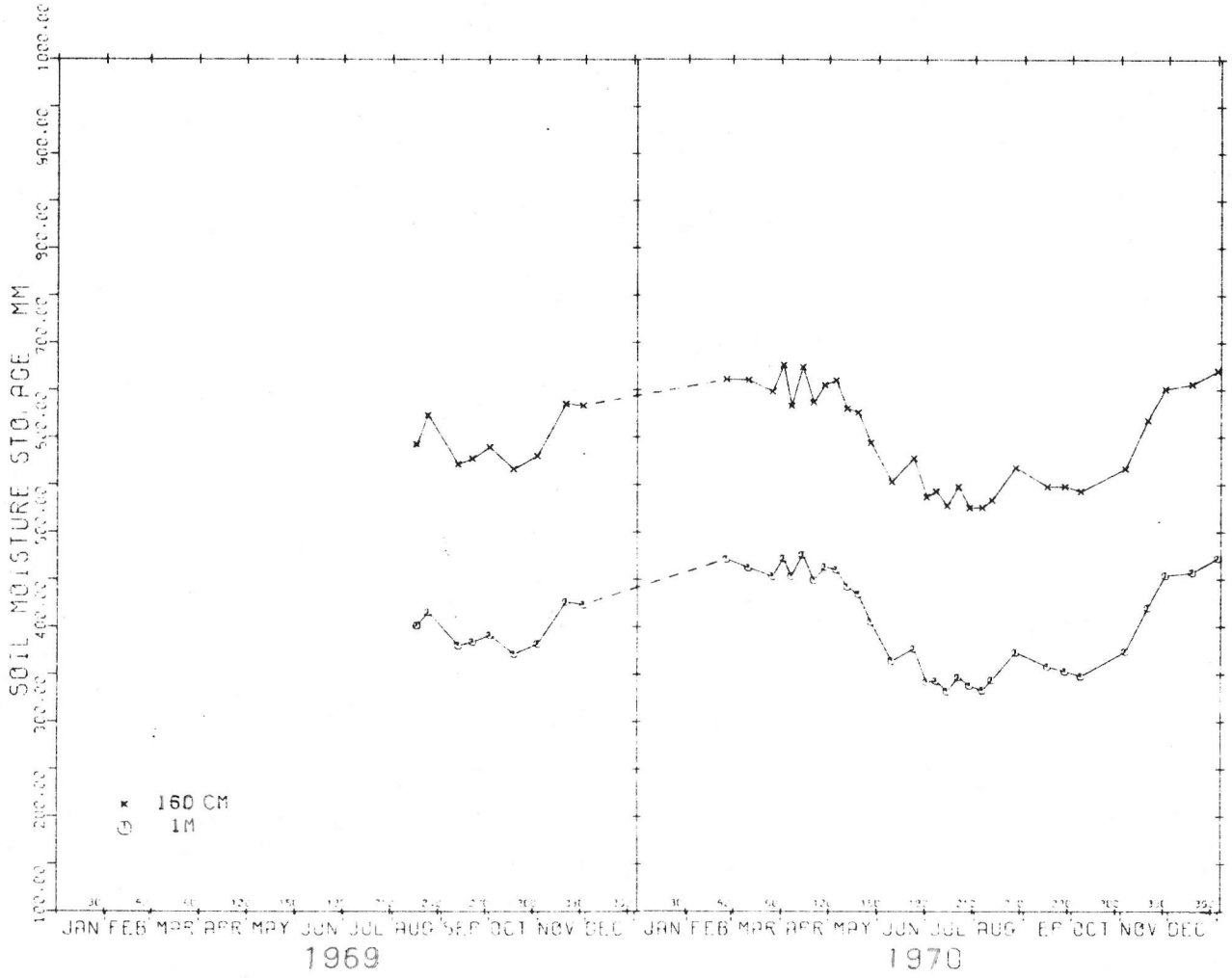


FIGURE 10

Site: T7 PM Texture: SAND Soil: BROWN EARTH (QUAINTON HILL) Landuse: PERMANENT PASTURE

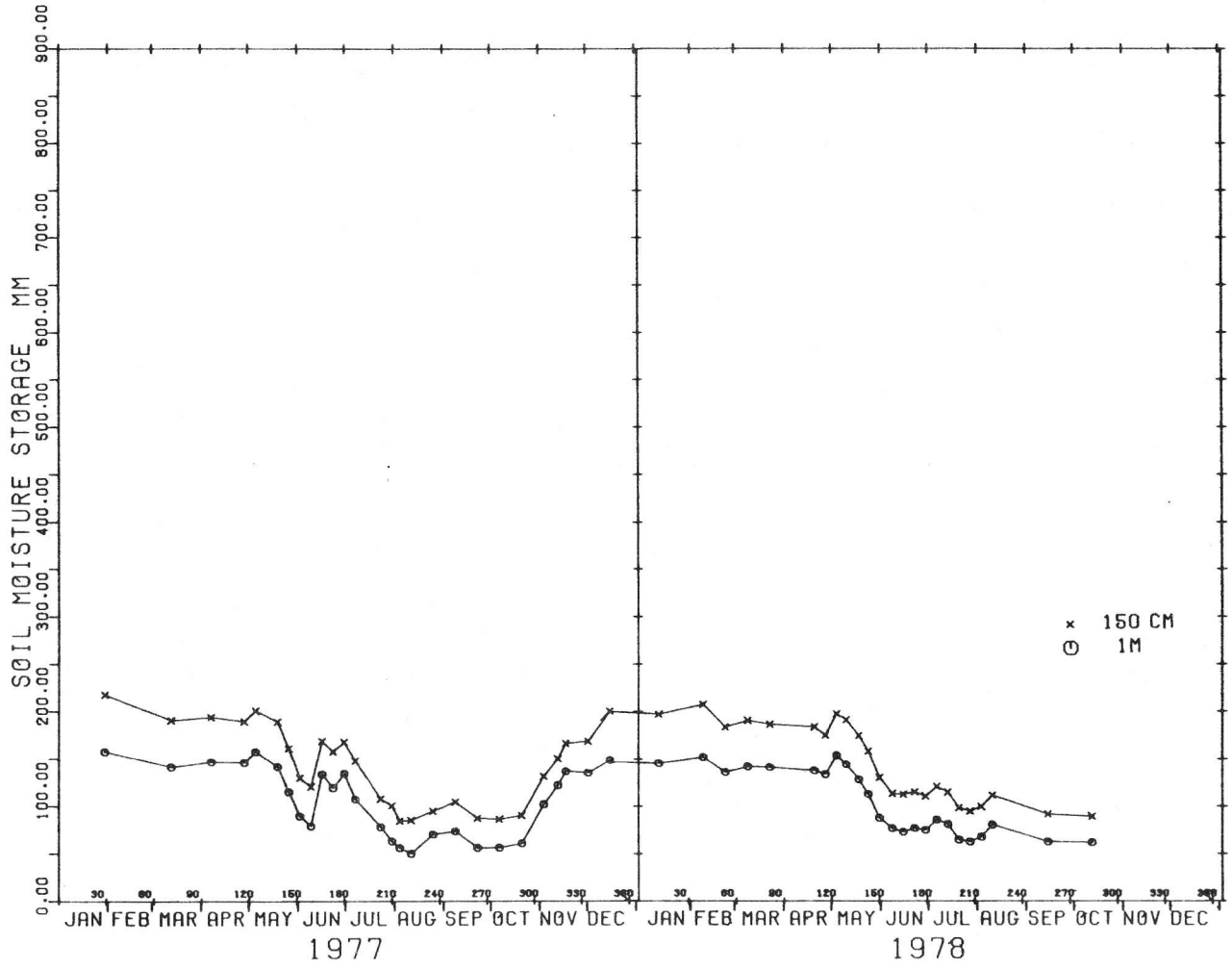


FIGURE 11

Site: G2 PM Texture: SAND Soil: BROWN EARTH (NEWPORT) Landuse: PERMANENT PASTURE

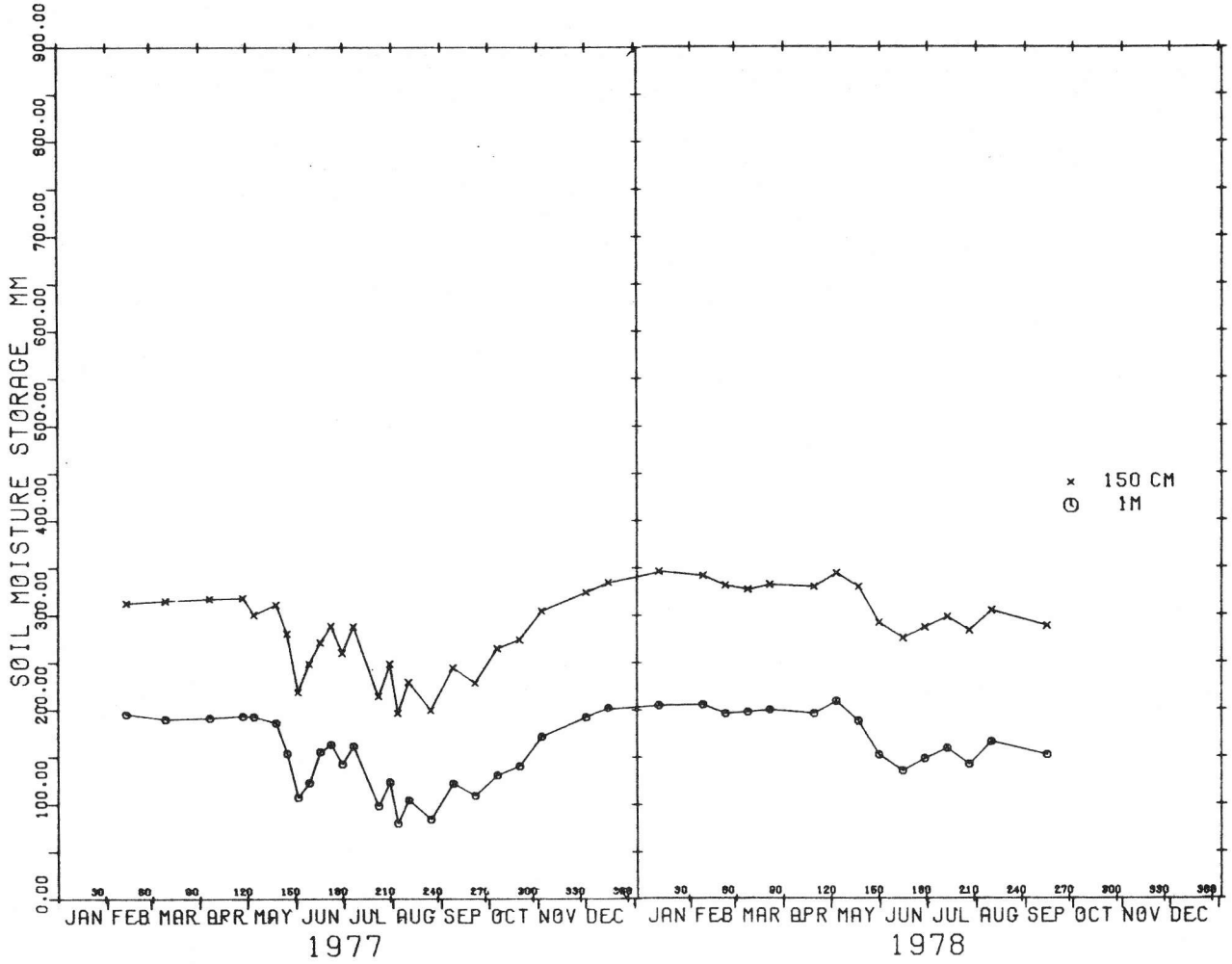


FIGURE 12

Site: G3 PM Texture: SAND Soil: BROWN EARTH (NEWPORT) Landuse: PERMANENT PASTURE

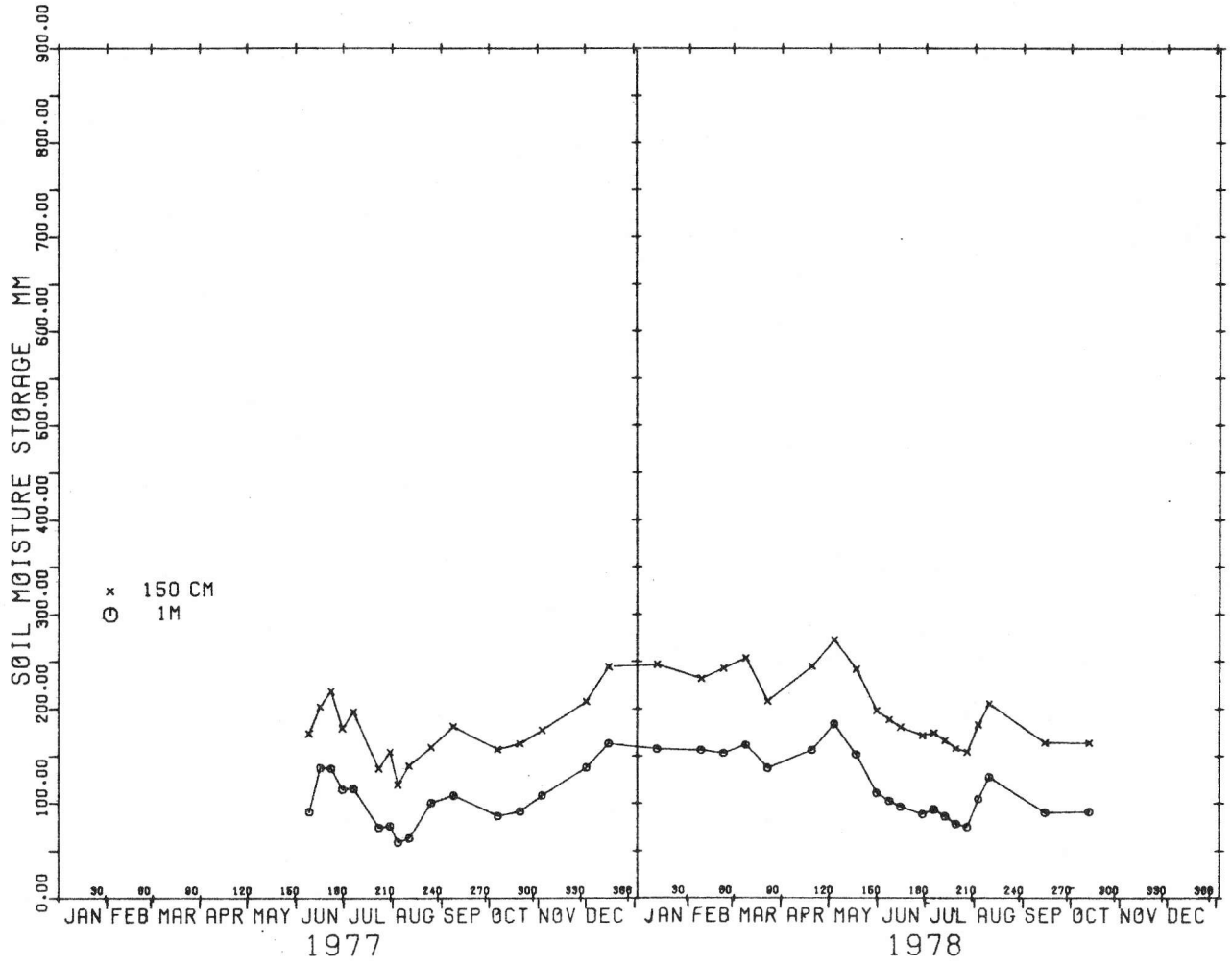


FIGURE 13

Site: G4 PM Texture: SANDS Soil: BROWN EARTH (NEWPORT) Landuse: MOWN GRASS

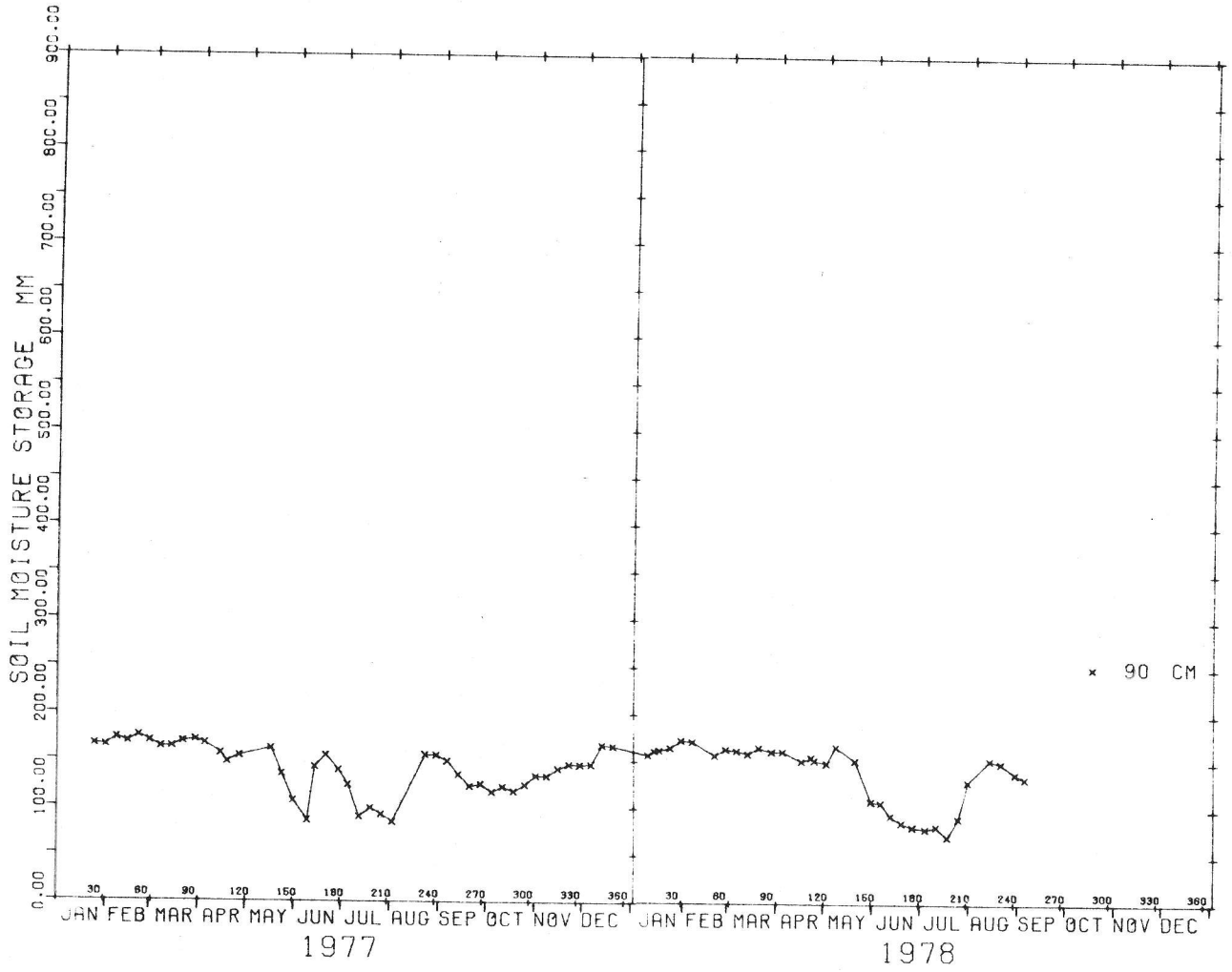


FIGURE 14

Site: L1 **PM Texture:** STONY SANDY TERRACE DRIFT **Soil:** BROWN EARTH (WICK) **Landuse:** GRASS

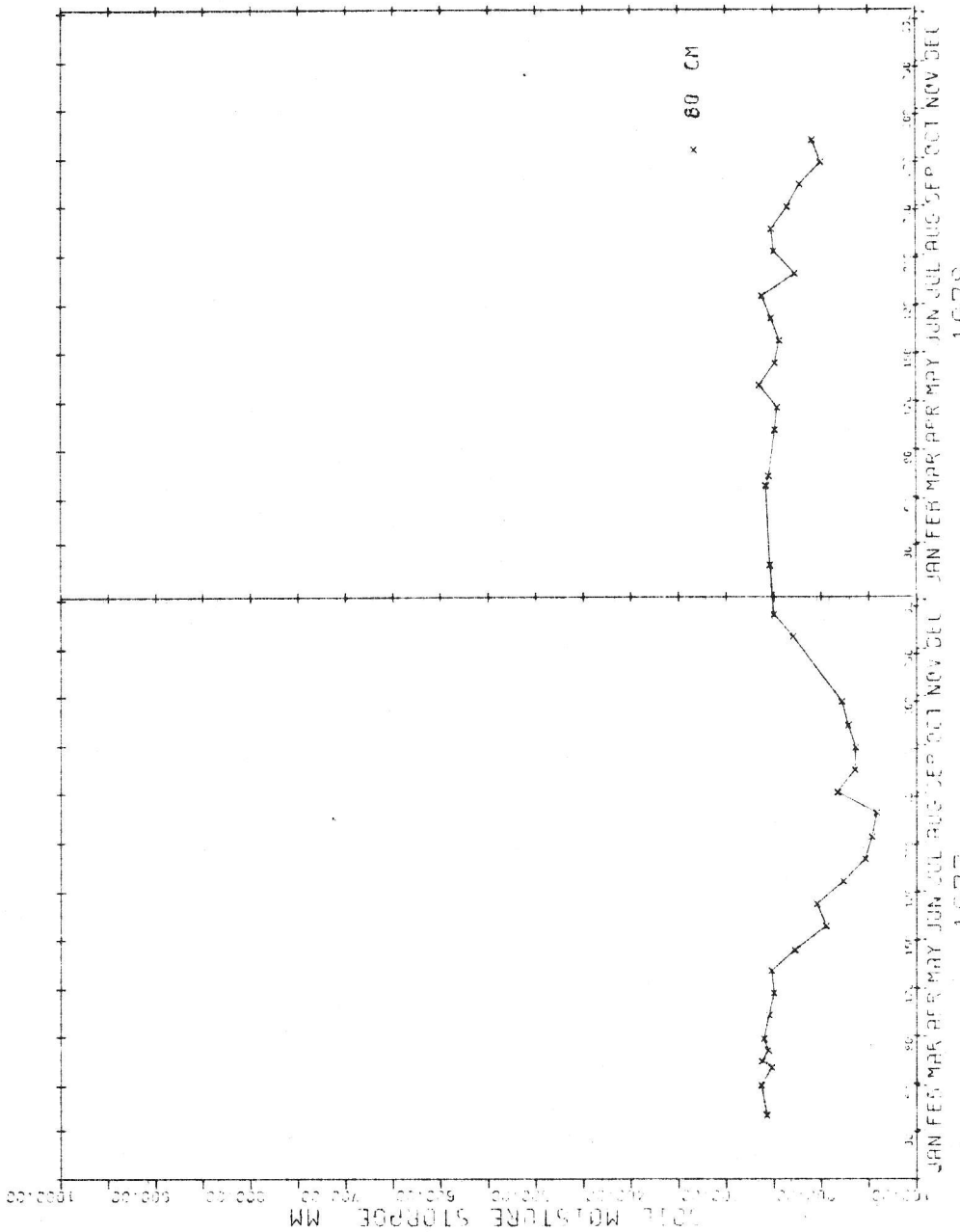


FIGURE 15

Site: E5 **PM Texture: LIMESTONE** **Soil: RENDZINA (SHERBORNE)** **Landuse: Arable**

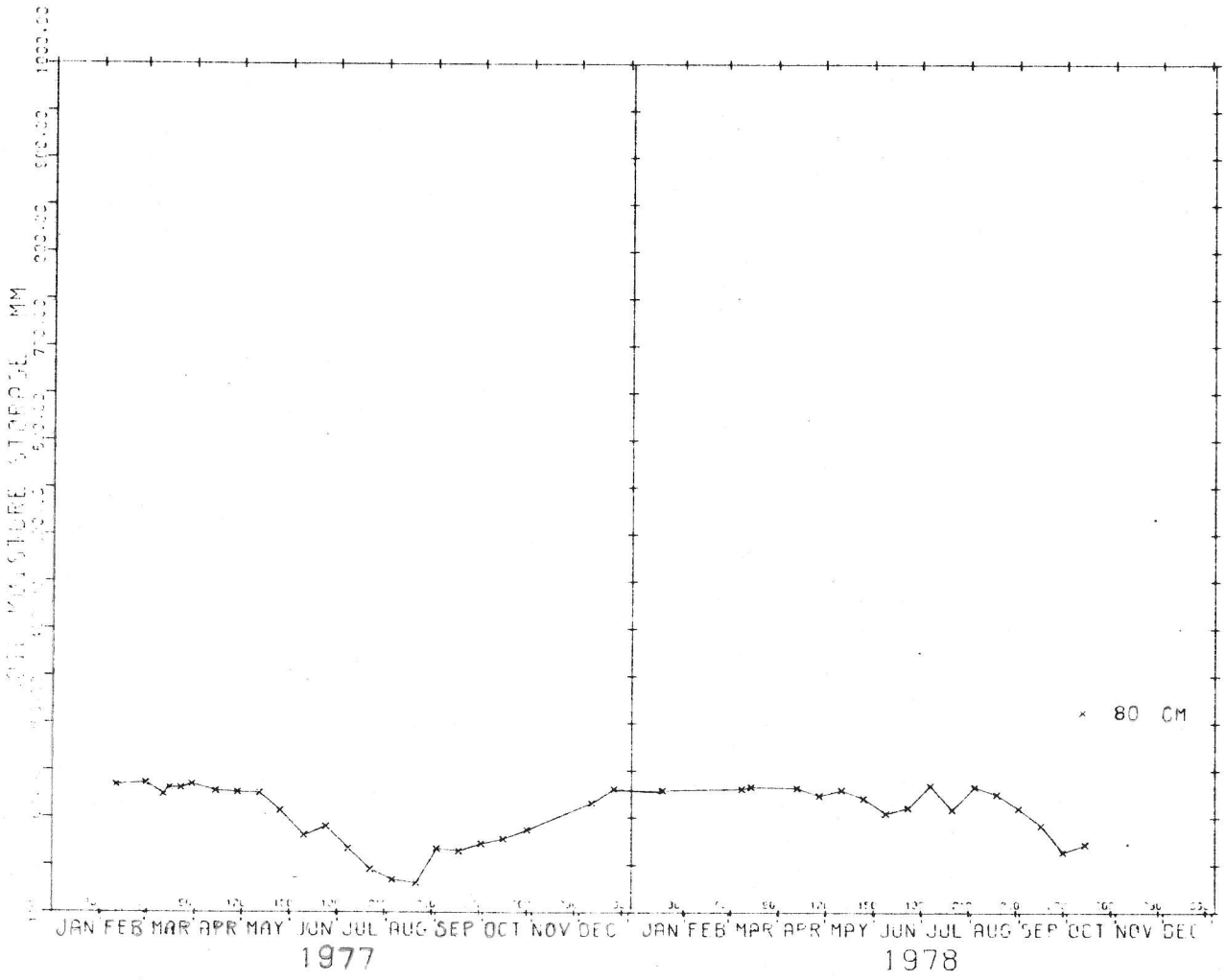


FIGURE 16

Site: E6 **PM Texture:** LIMESTONE **Soil:** RENDZINA (SHERBORNE) **Landuse:** ARABLE

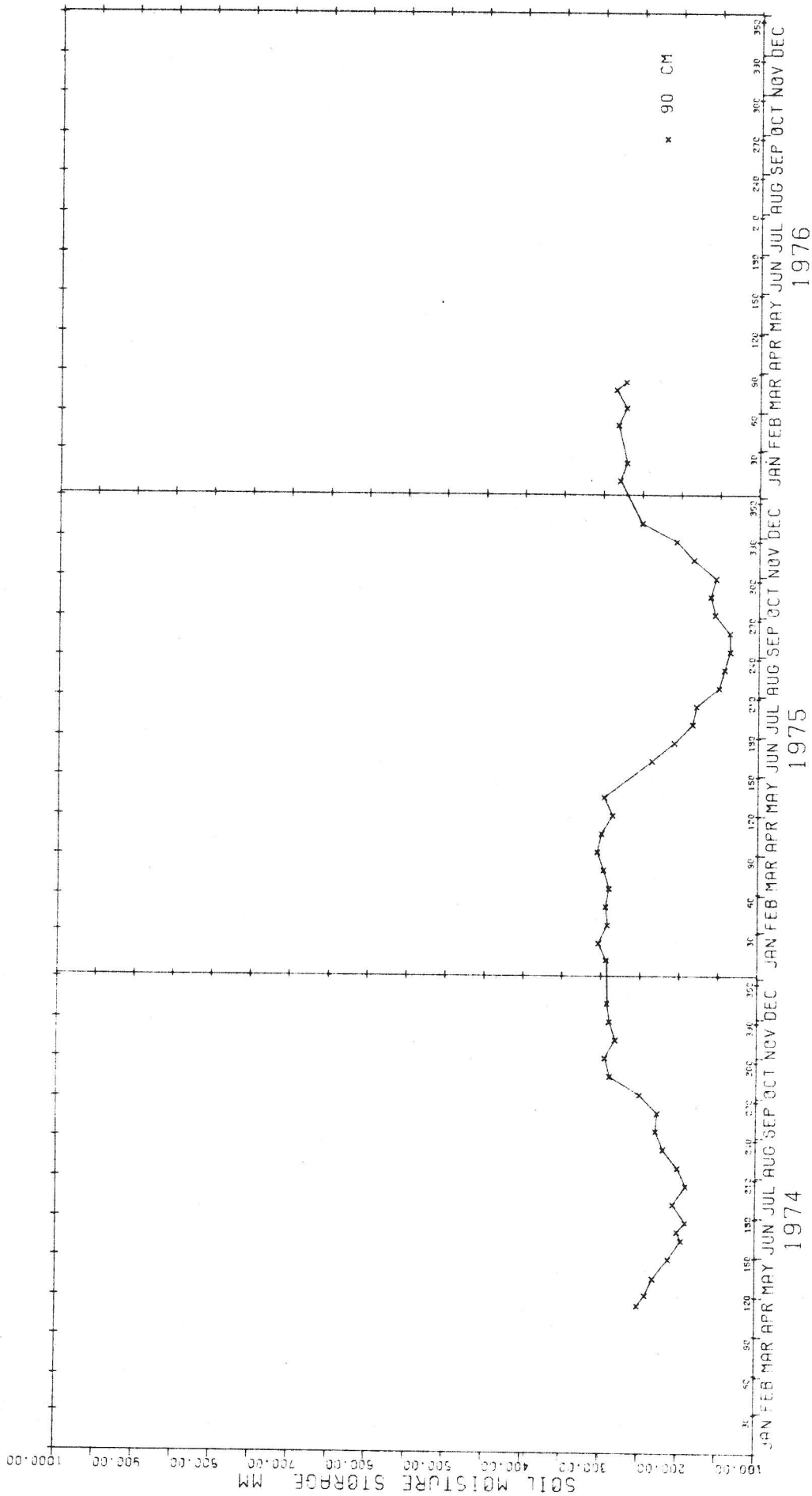


FIGURE 17

Site: E3 PM Texture: CHALK Soil: RENDZINA (ANDOVER) Landuse: PERMANENT PASTURE

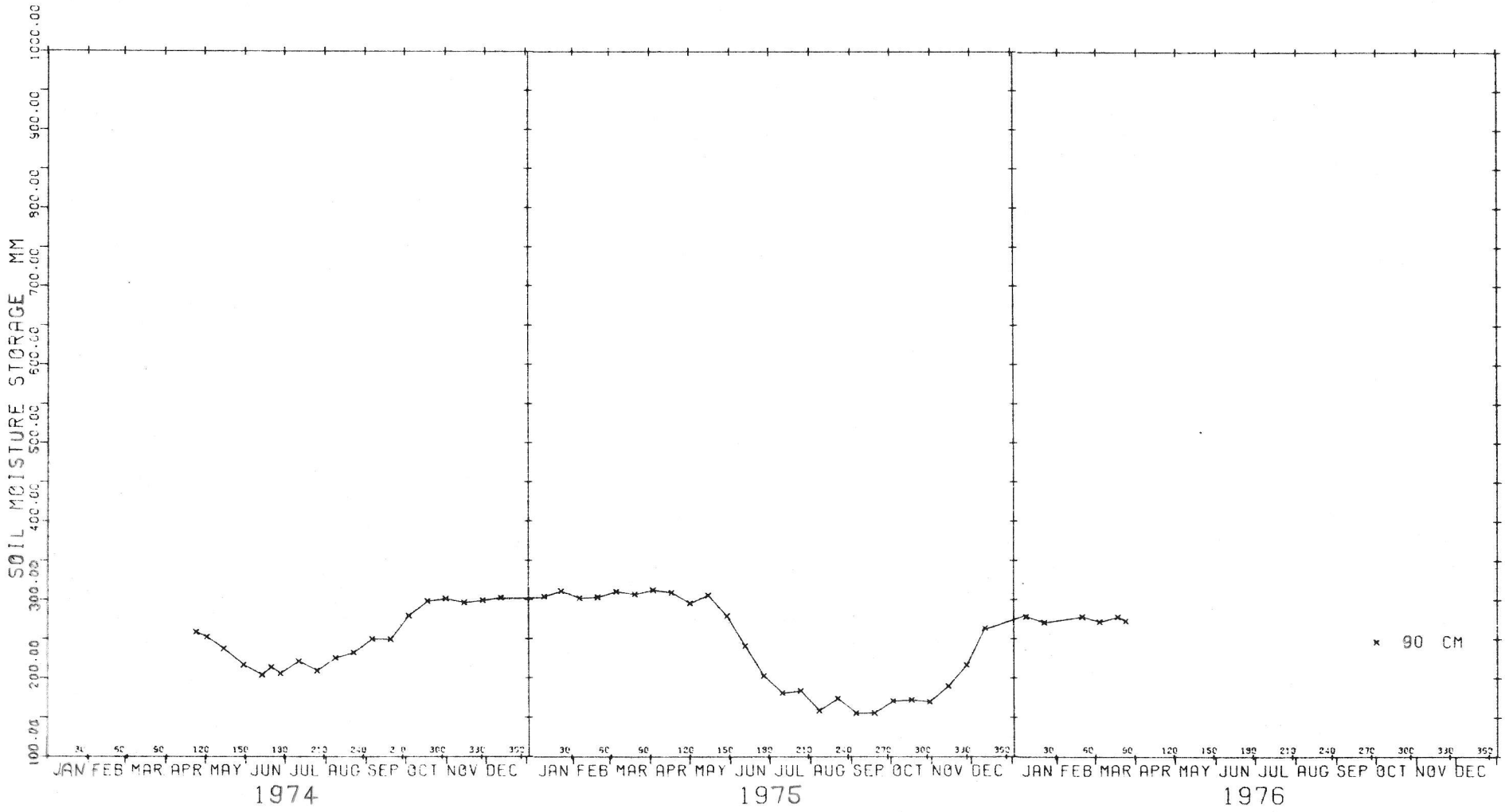


FIGURE 18

Site: E4 **PM Texture:** CHALK **Soil:** RENDZINA (ANDOVER) **Landuse:** PERMANENT PASTURE

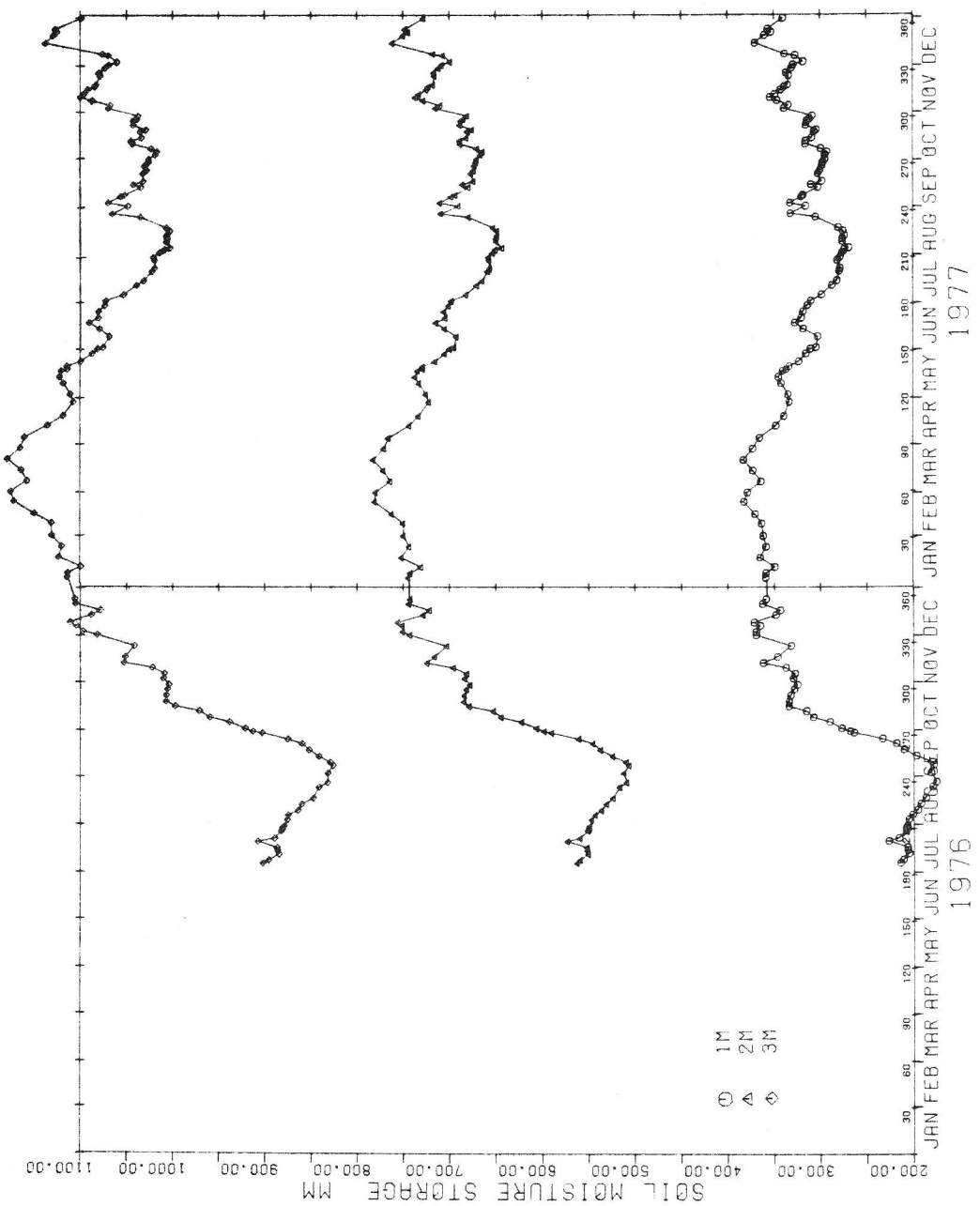


FIGURE 19

Site: T19 PM Texture: CHALK Soil: RENDZINA (ANDOVER) Landuse: GRASS

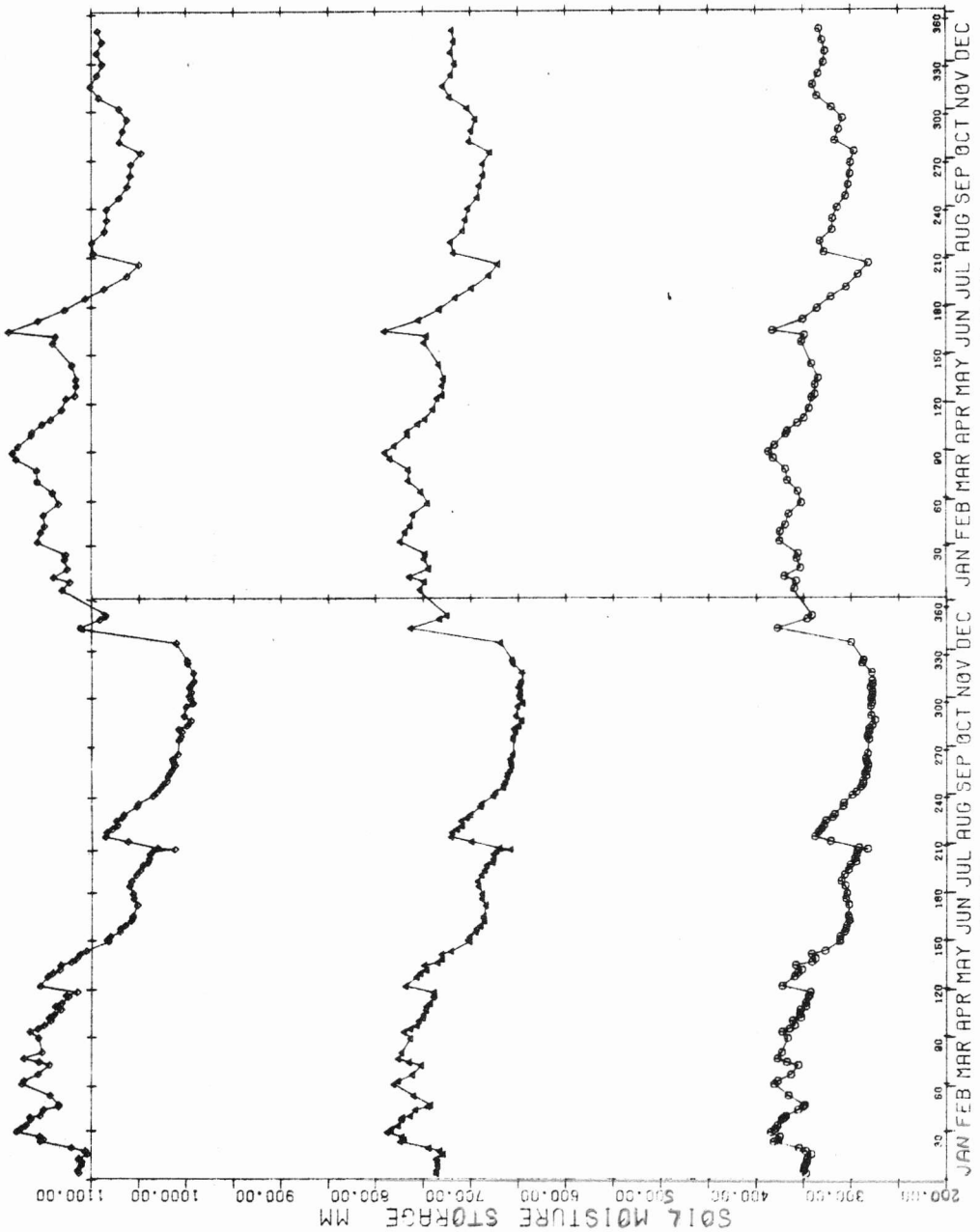


FIGURE 19 (Contd.)

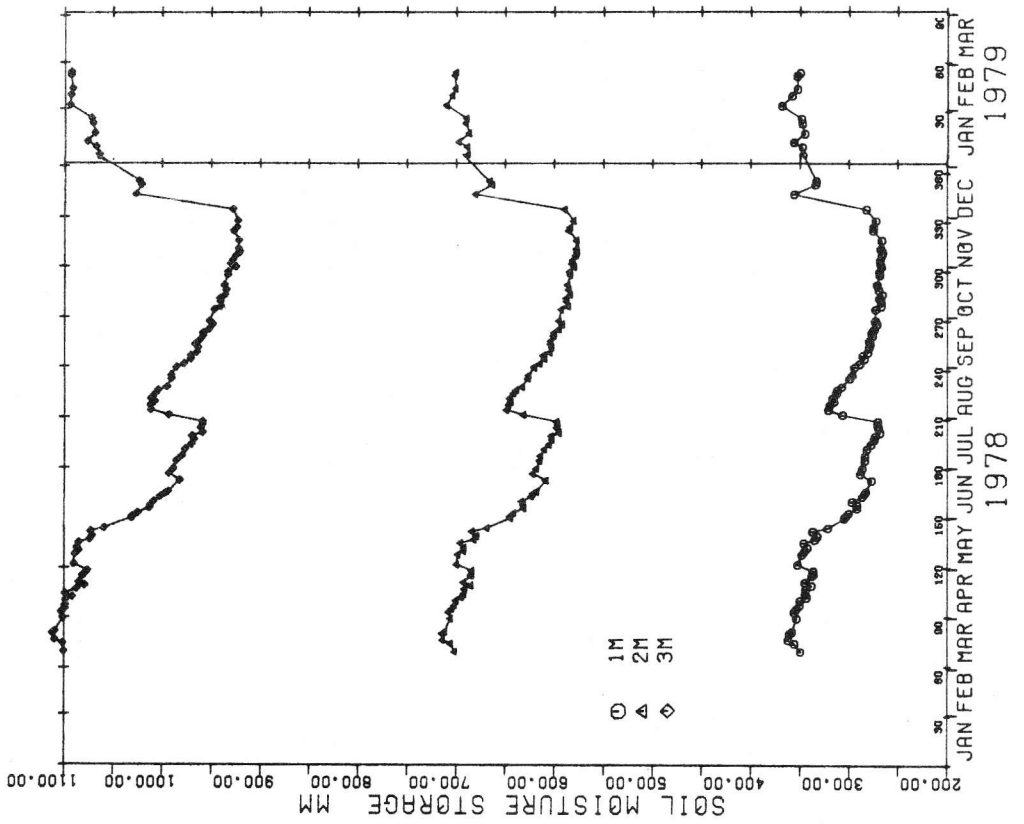


FIGURE 20a

Site: T21
PM Texture: CHALK
Soil: RENDZINA (ANDOVER)
Landuse: SPRING BARLEY

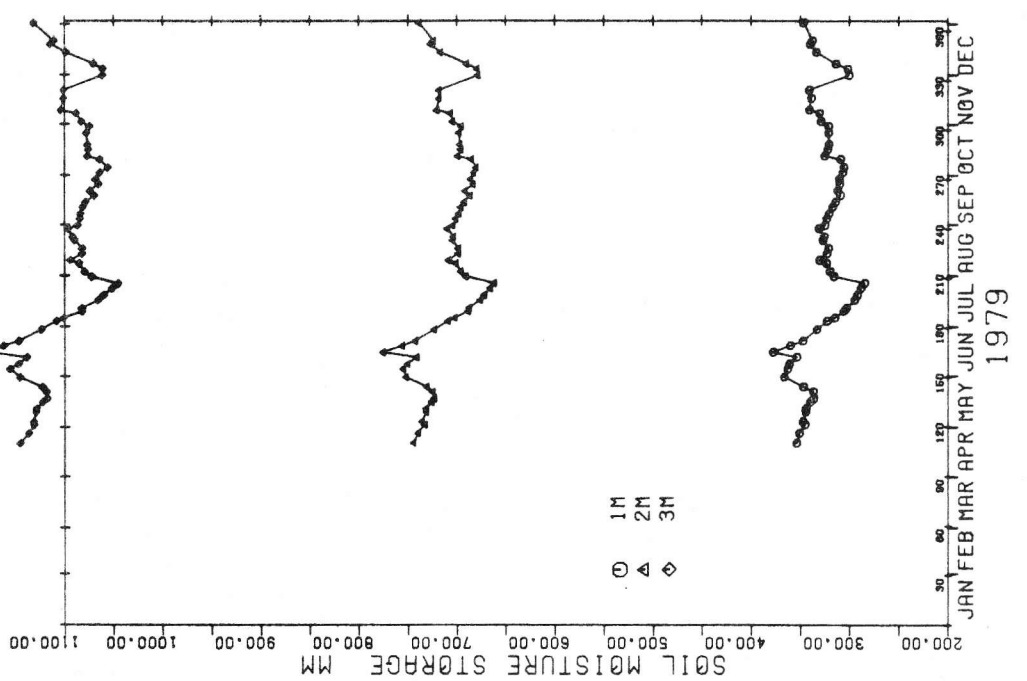


FIGURE 20b

Site: T22
PM Texture: CHALK
Soil: RENDZINA (ANDOVER)
Landuse: SPRING BARLEY

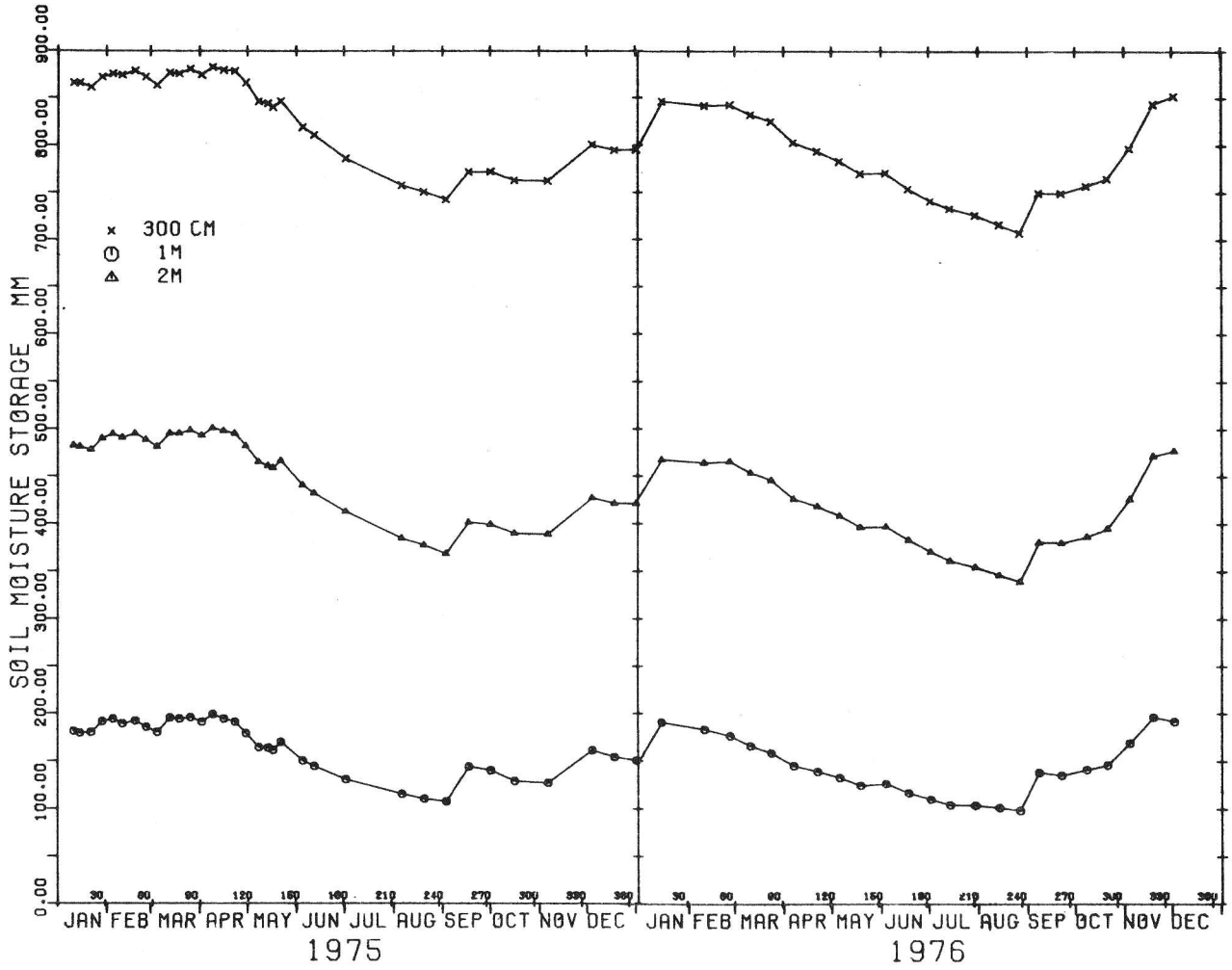


FIGURE 21

Site: T16 PM Texture: CHALK Soil: RENDZINA (NEWMARKET-METHWOLD) Landuse: CONIFEROUS WOOD

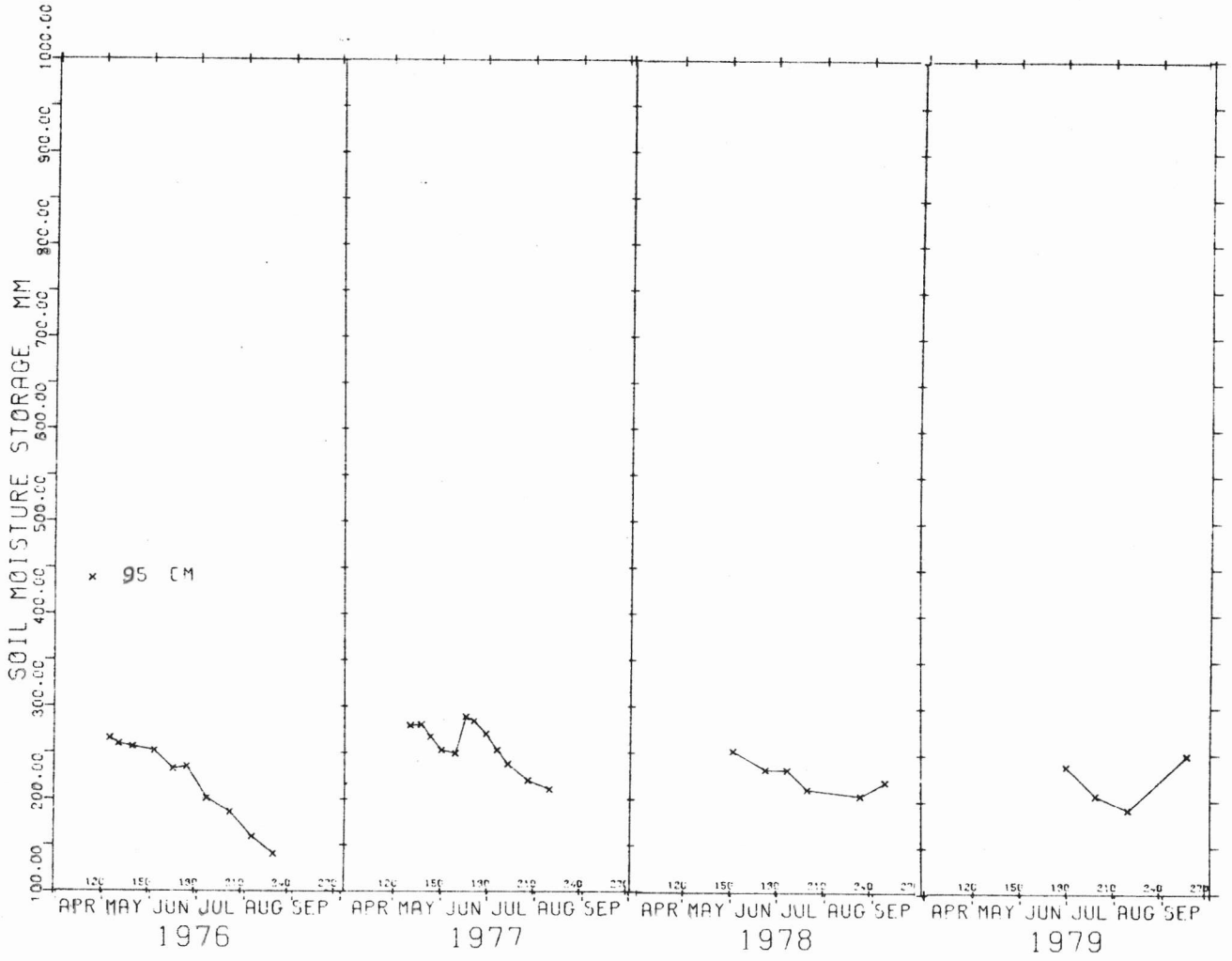


FIGURE 22

Site: P1 PM Texture: CLAYEY (MARLS AND SANDSTONE) Soil: BROWN EARTH (GREINTON) Landuse: APPLE ORCHARD (CONVENTIONAL)

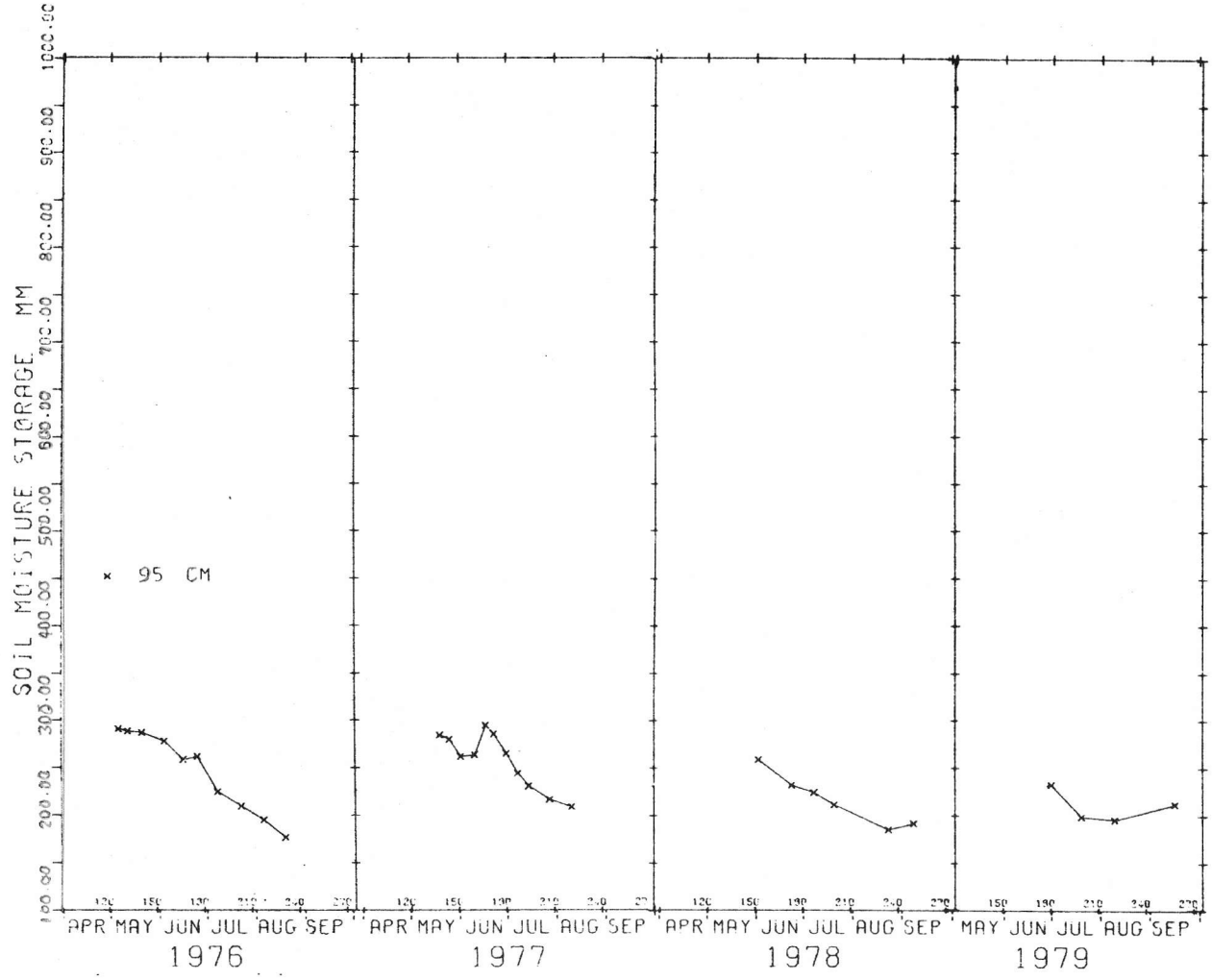


FIGURE 23

Site: P5 PM Texture: CLAYEY (MARLS AND SANDSTONE) Soil: BROWN EARTH (GREINTON) Landuse: APPLE ORCHARD (TOTAL HERBICIDE TREATMENT)

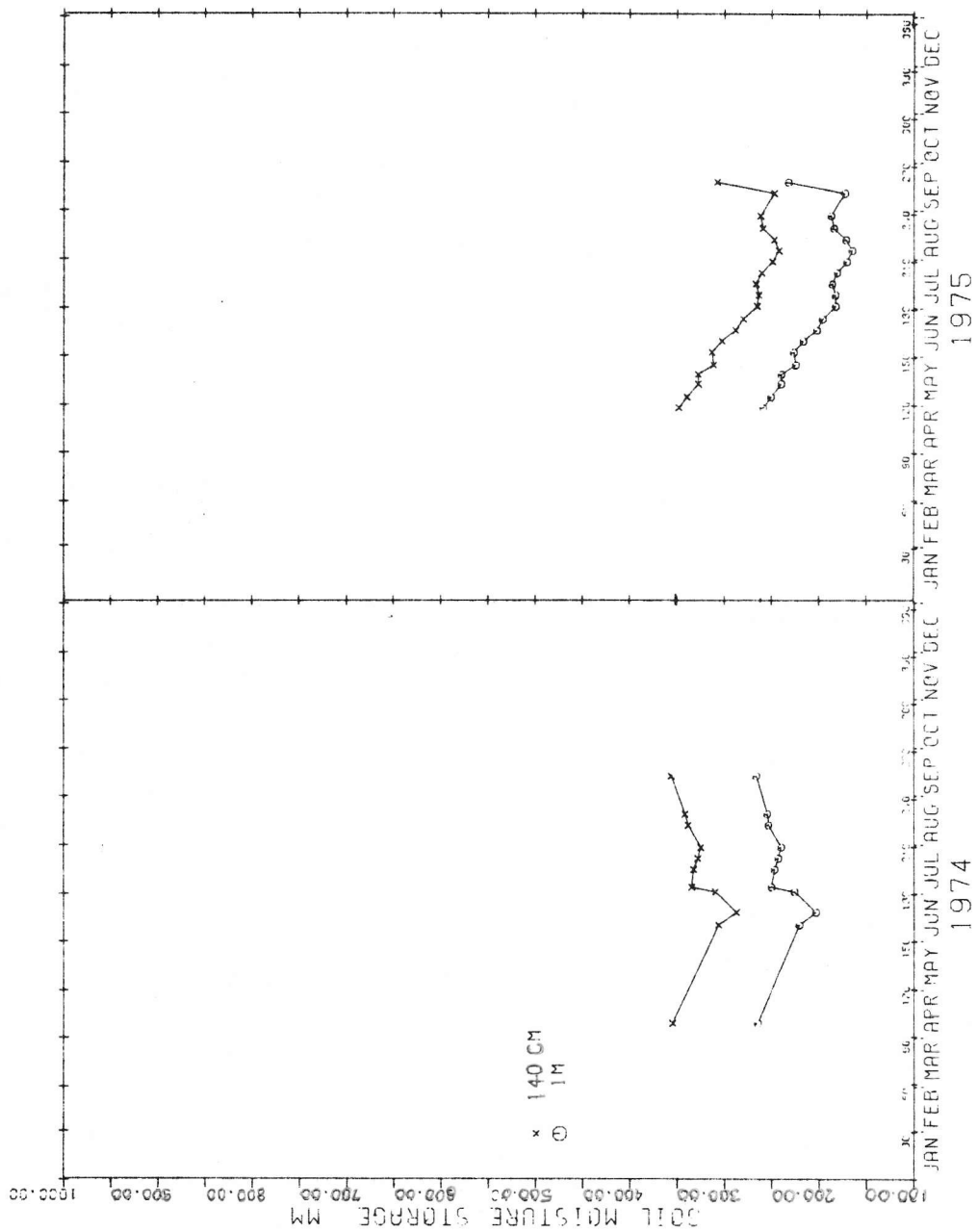


FIGURE 24

Site: 01 PM Texture: LOAMY DRIFT Soil: BROWN EARTH (TICKENHAM) Landuse: APPLE ORCHARD (CONVENTIONAL)

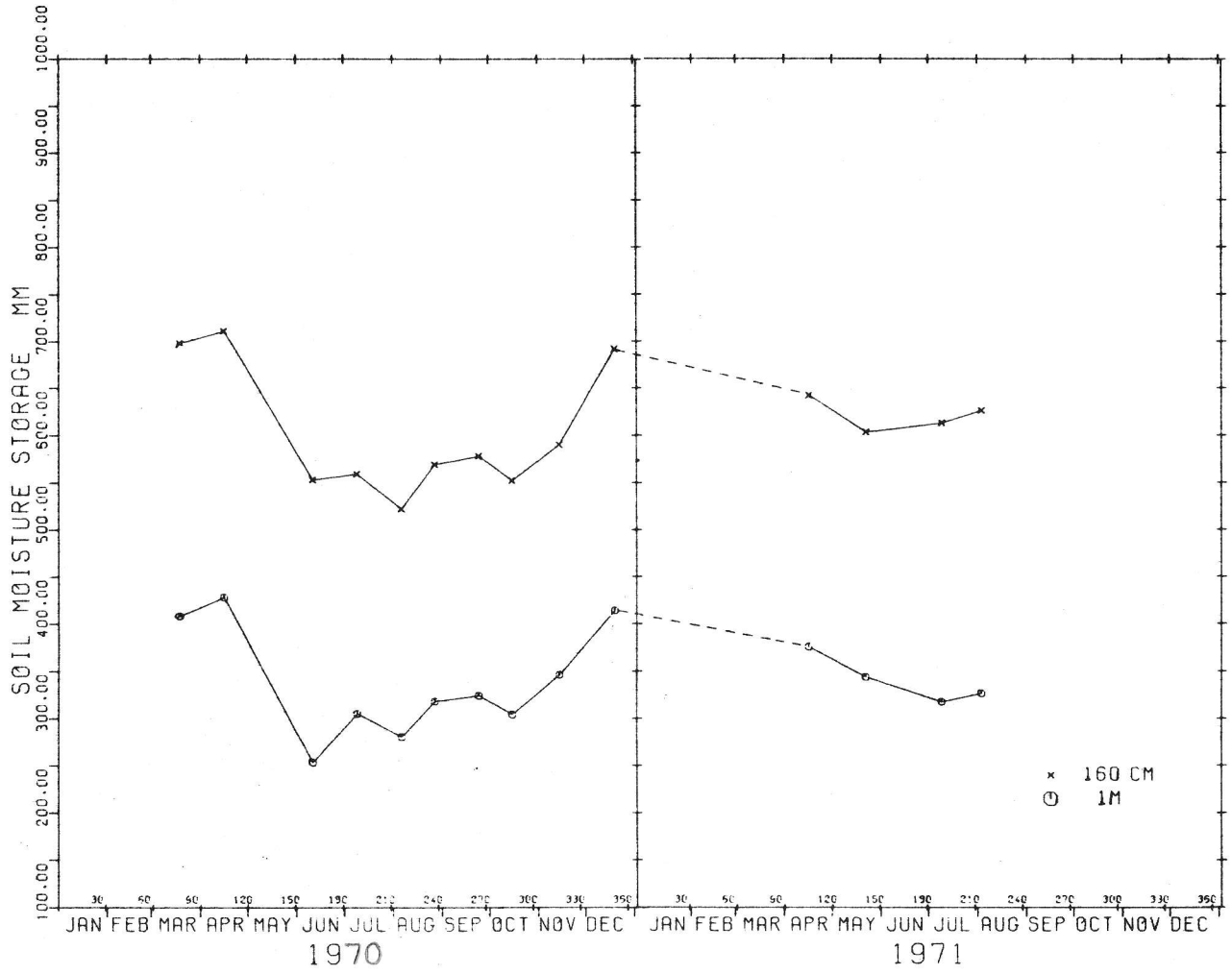


FIGURE 25

Site: T9 **PM Texture:** LOAMY CHALK DRIFT **Soil:** BROWN CALCAREOUS (SWAFFHAM-PRIOR) **Landuse:** PERMANENT PASTURE

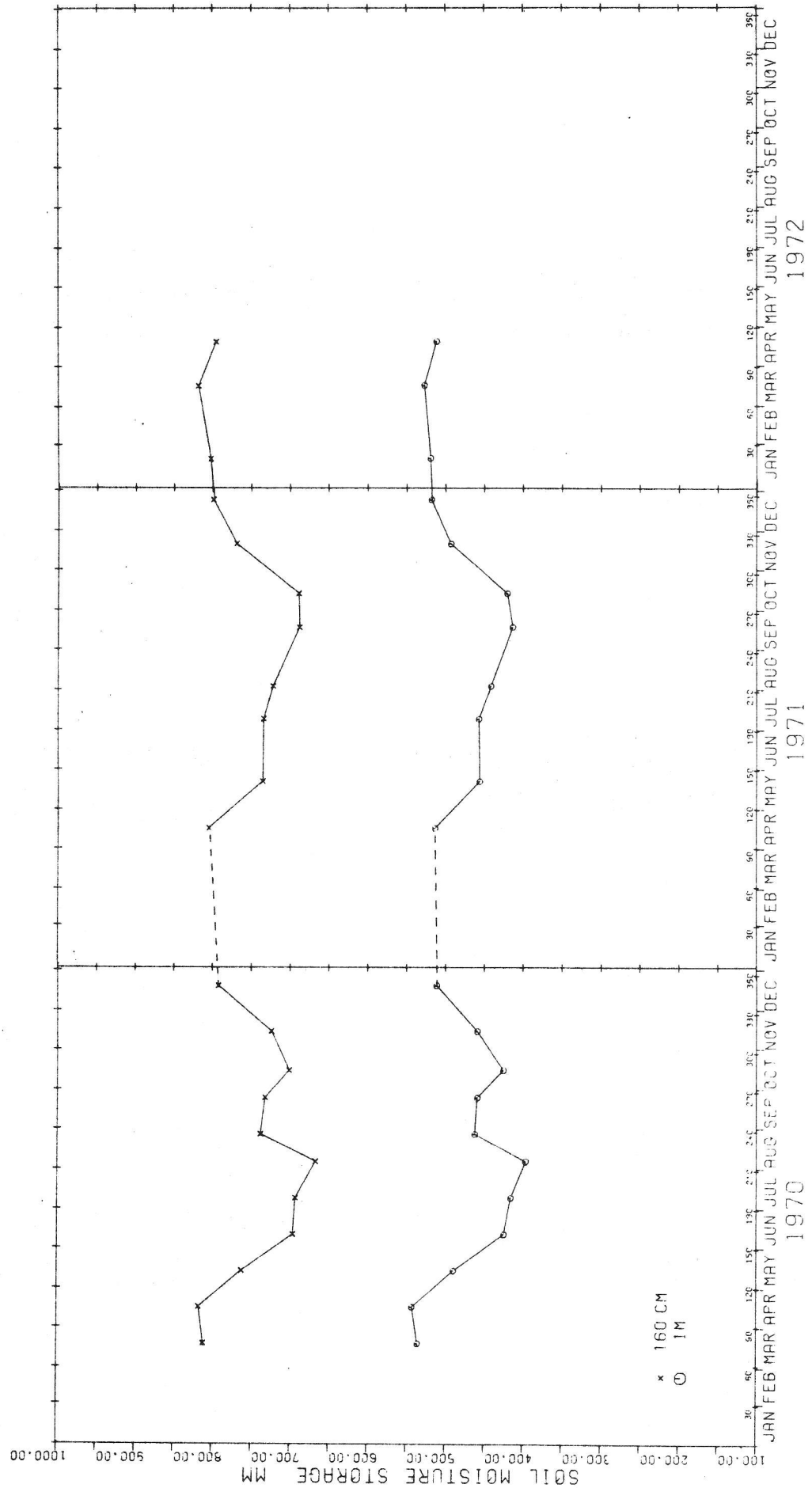


FIGURE 26

Site: T10 **PM Texture:** LOAMY CHALK DRIFT **Soil:** BROWN CALCAREOUS **Landuse:** PERMANENT PASTURE (SWAFFHAM-PRIOR)

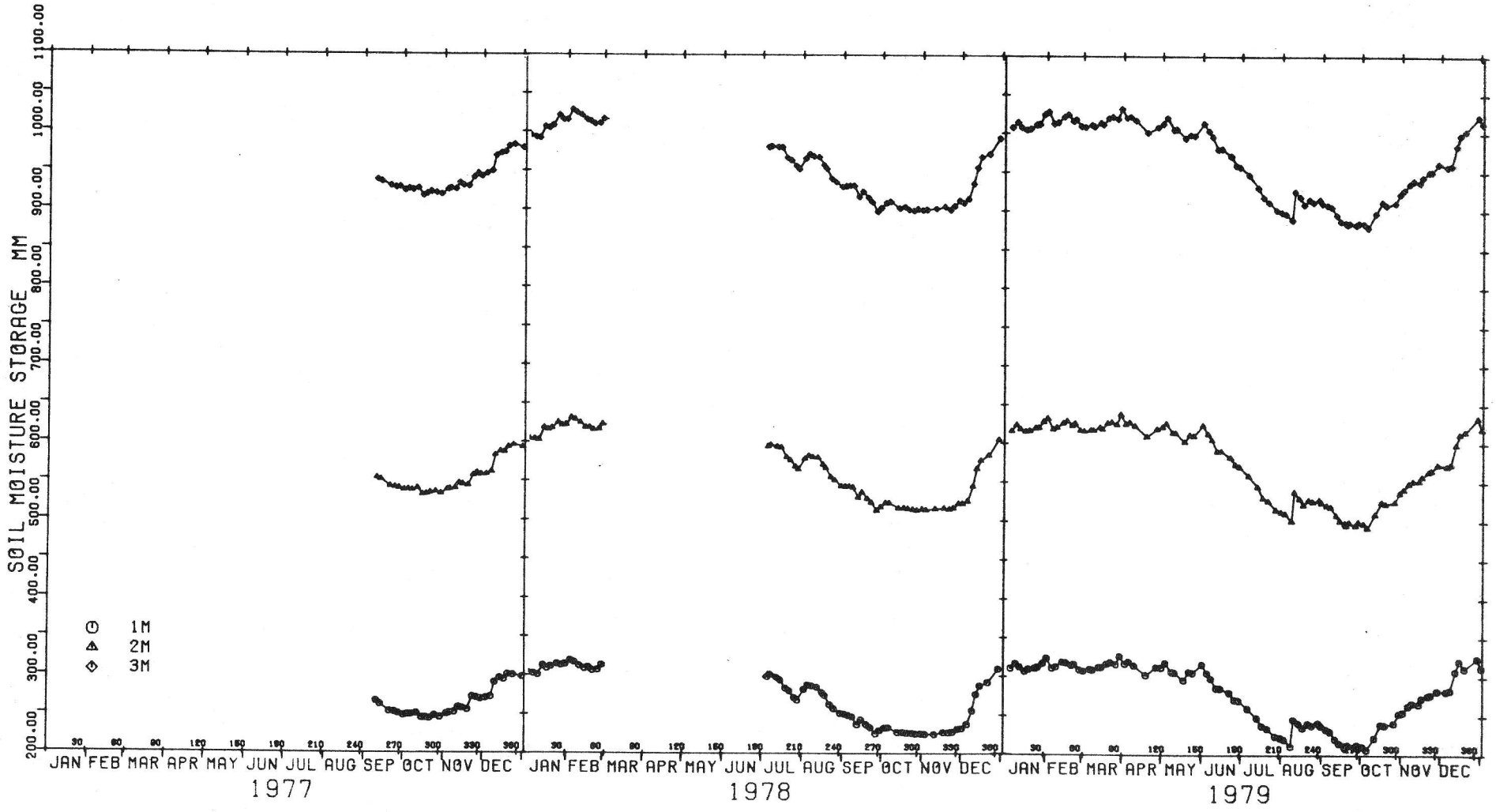


FIGURE 27

Site: T18 PM Texture: LOAMY CHALK DRIFT Soil: BROWN CALCAREOUS (SWAFFHAM-PRIOR) Landuse: MOWN GRASS

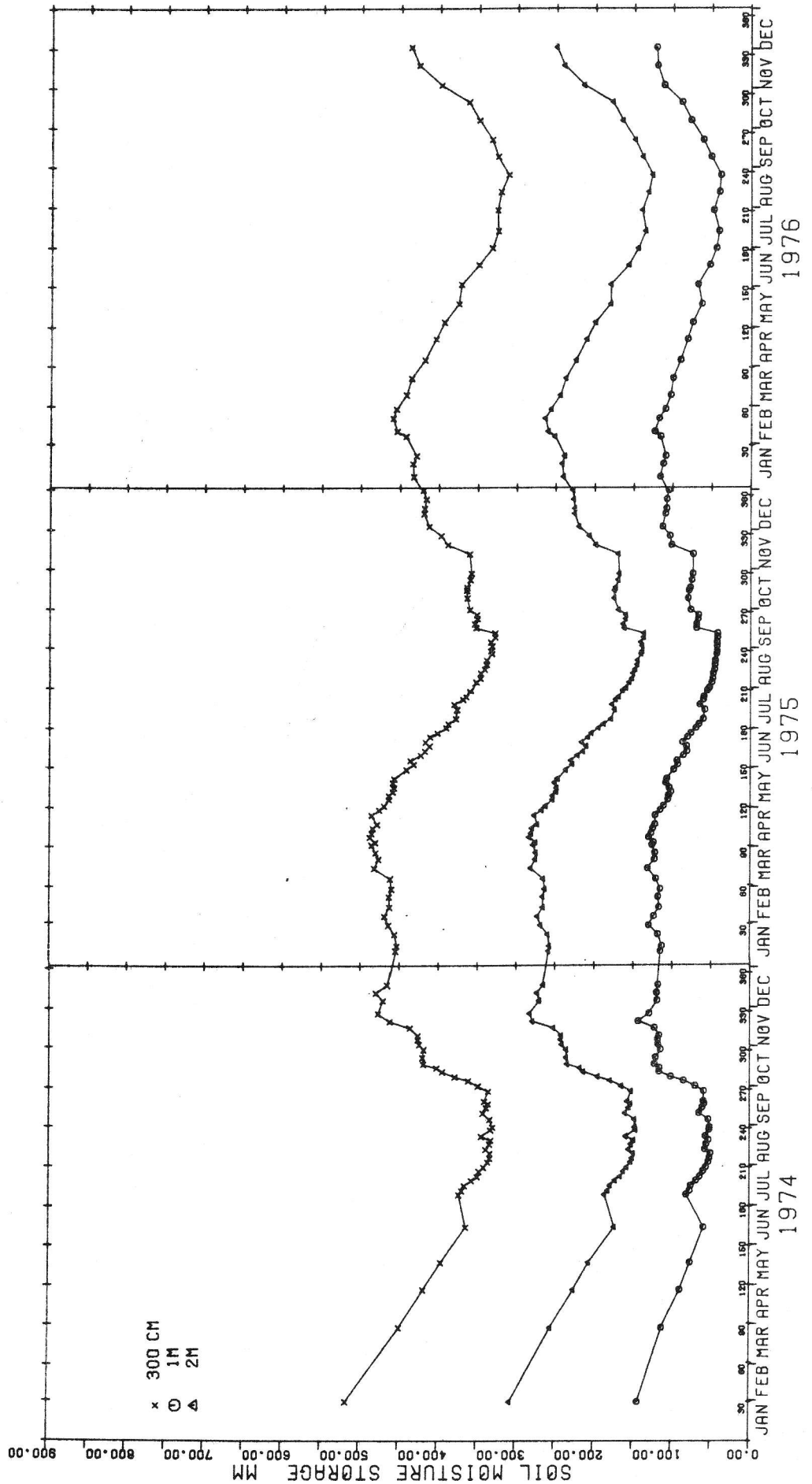


FIGURE 28

Site: T15 PM Texture: SAND Soil: BROWN CALCAREOUS (WORLINGTON) Landuse: CONIFEROUS WOOD

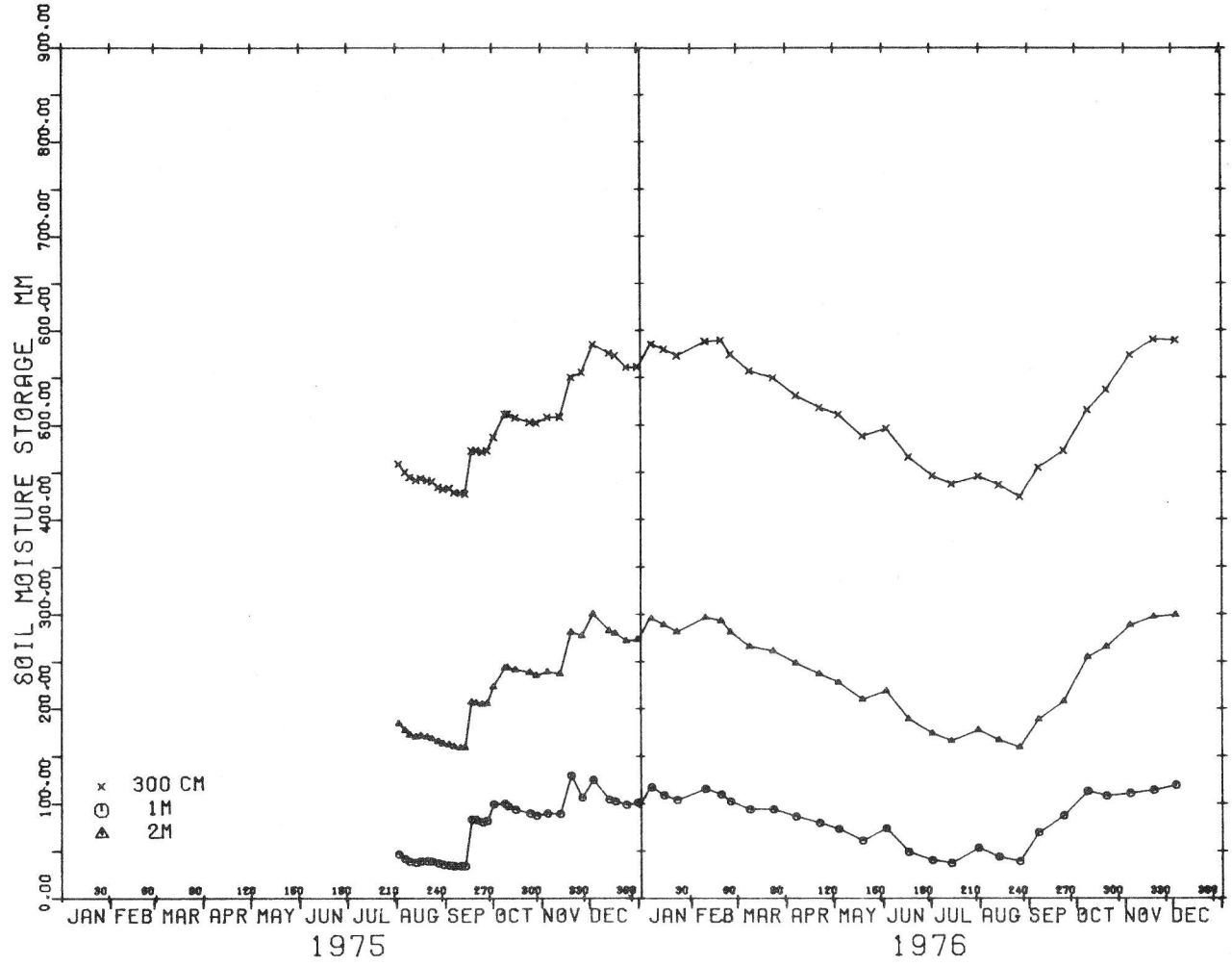


FIGURE 29

Site: T17 PM Texture: SAND Soil: BROWN CALCAREOUS (WORLINGTON) Landuse: GRASS

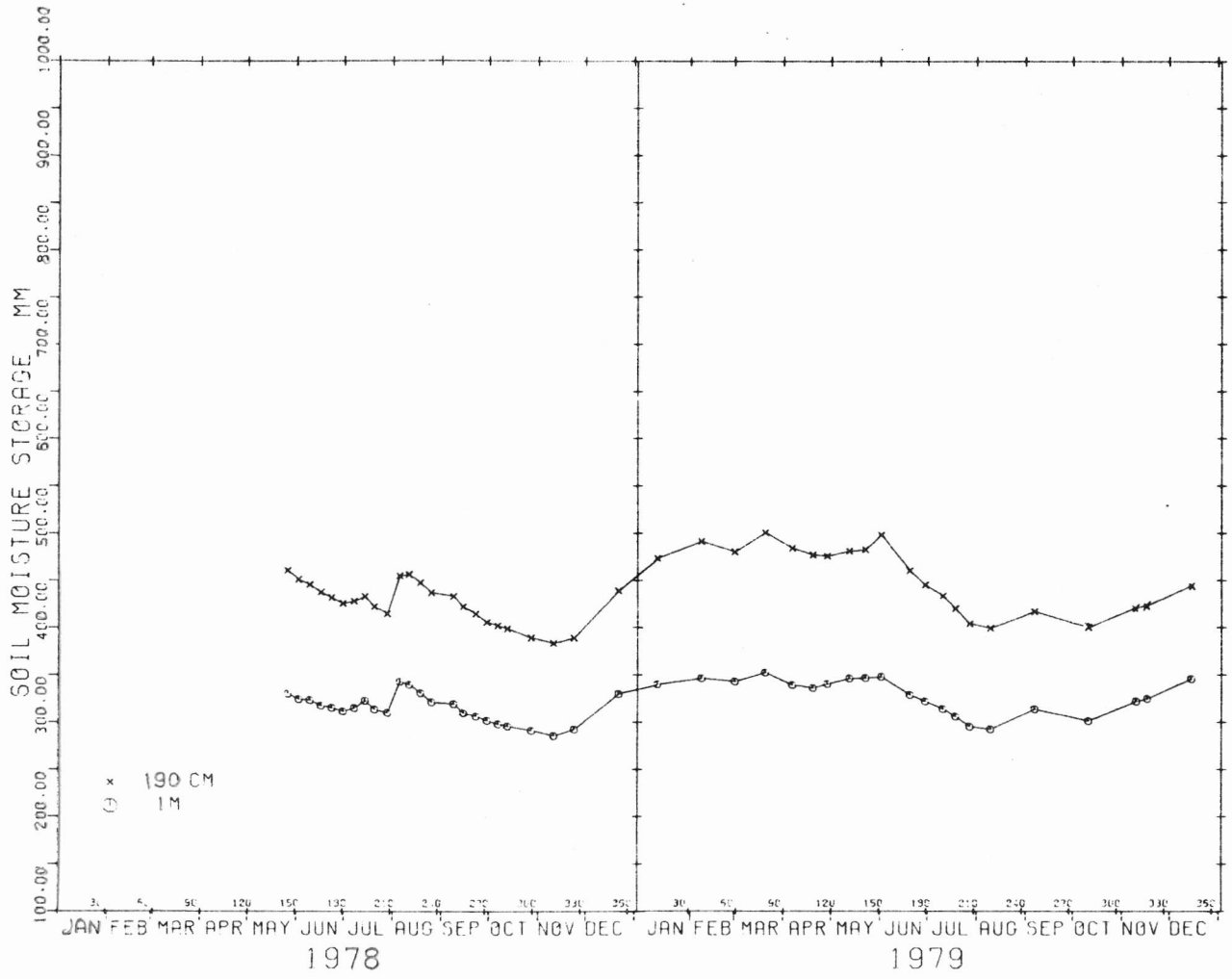
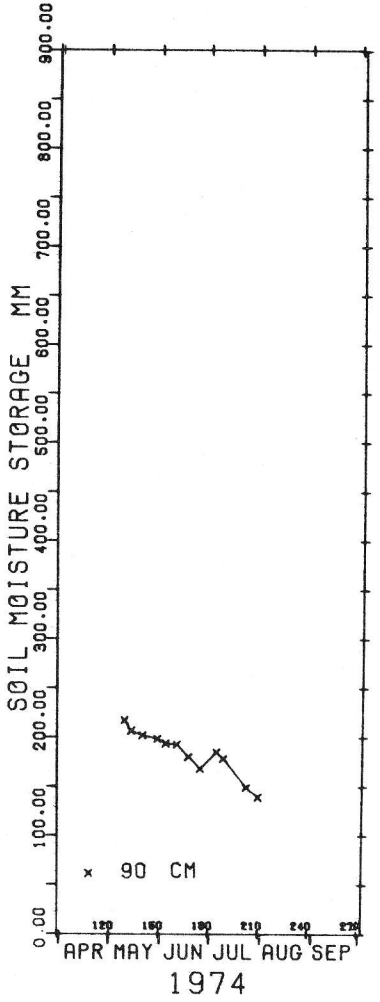
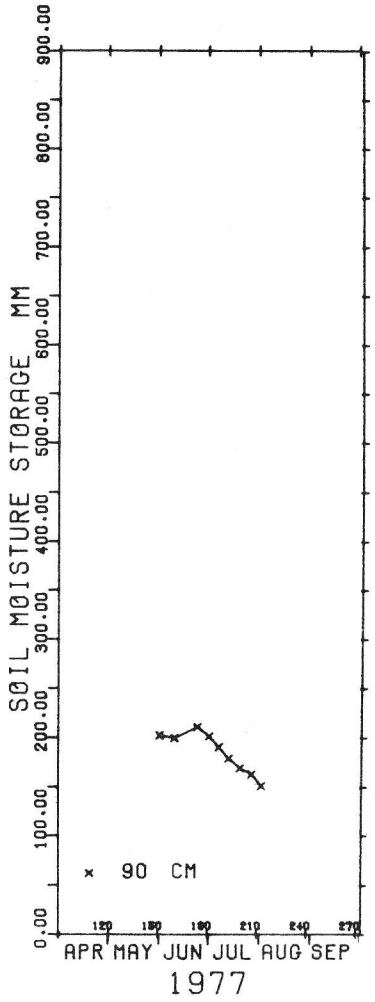


FIGURE 30

Site: Q9 **PM Texture:** SAND **Soil:** GLEYED BROWN EARTH (KINGTON) **Landuse:** MIXED WOODLAND





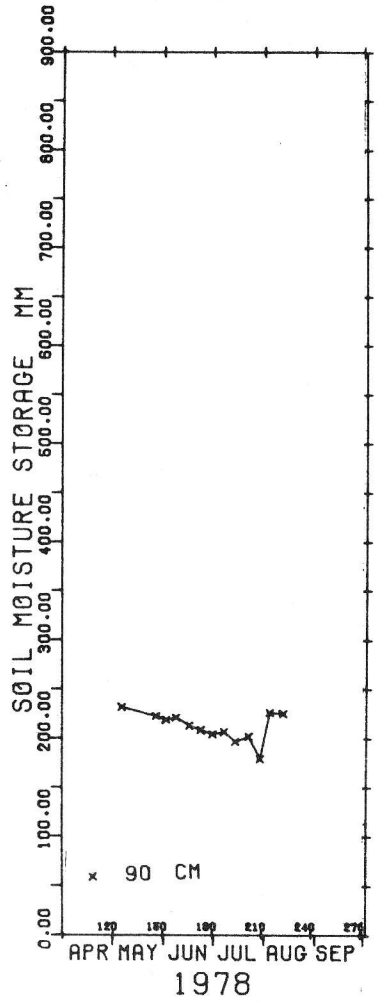


FIGURE 31a, b and c

Site: K1, K2, K3 PM Texture: SANDY TERRACE DRIFT Soil: GLEYED BROWN EARTH (ARROW) Landuse: BROAD BEANS

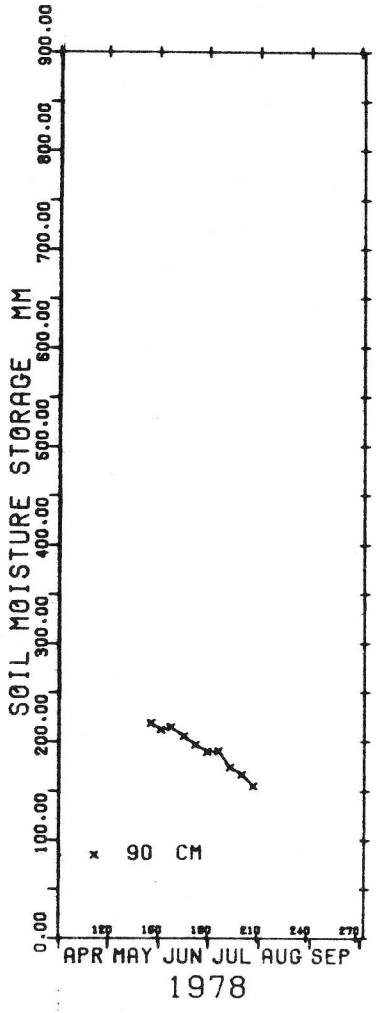


FIGURE 32a

Site: K4
PM Texture: SANDY TERRACE DRIFT
Soil: GLEYED BROWN EARTH (ARROW)
Landuse: CABBAGES

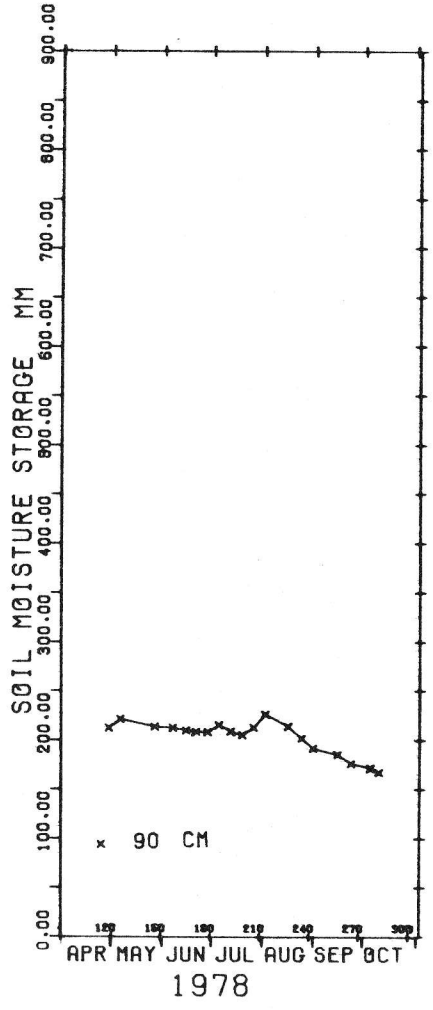


FIGURE 32b

Site: K5
PM Texture: SANDY TERRACE DRIFT
Soil: GLEYED BROWN EARTH (ARROW)
Landuse: LEEKS

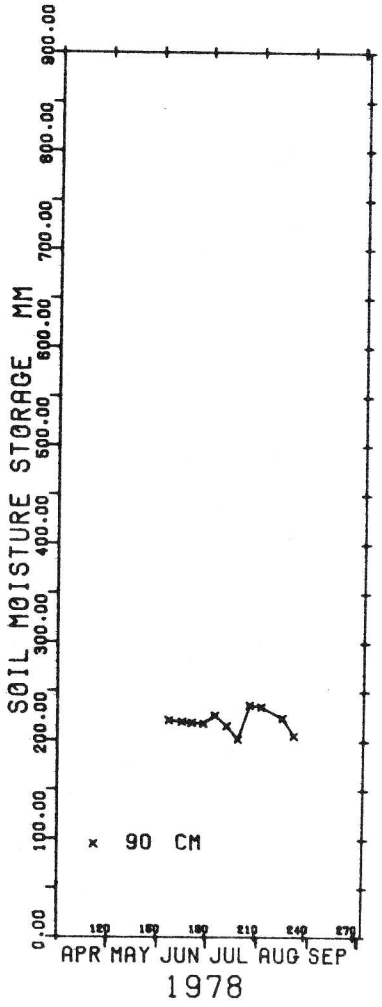


FIGURE 32c

Site: K5
PM Texture: SANDY TERRACE DRIFT
Soil: GLEYED BROWNT EARTH (ARROW)
Landuse: RED BEET

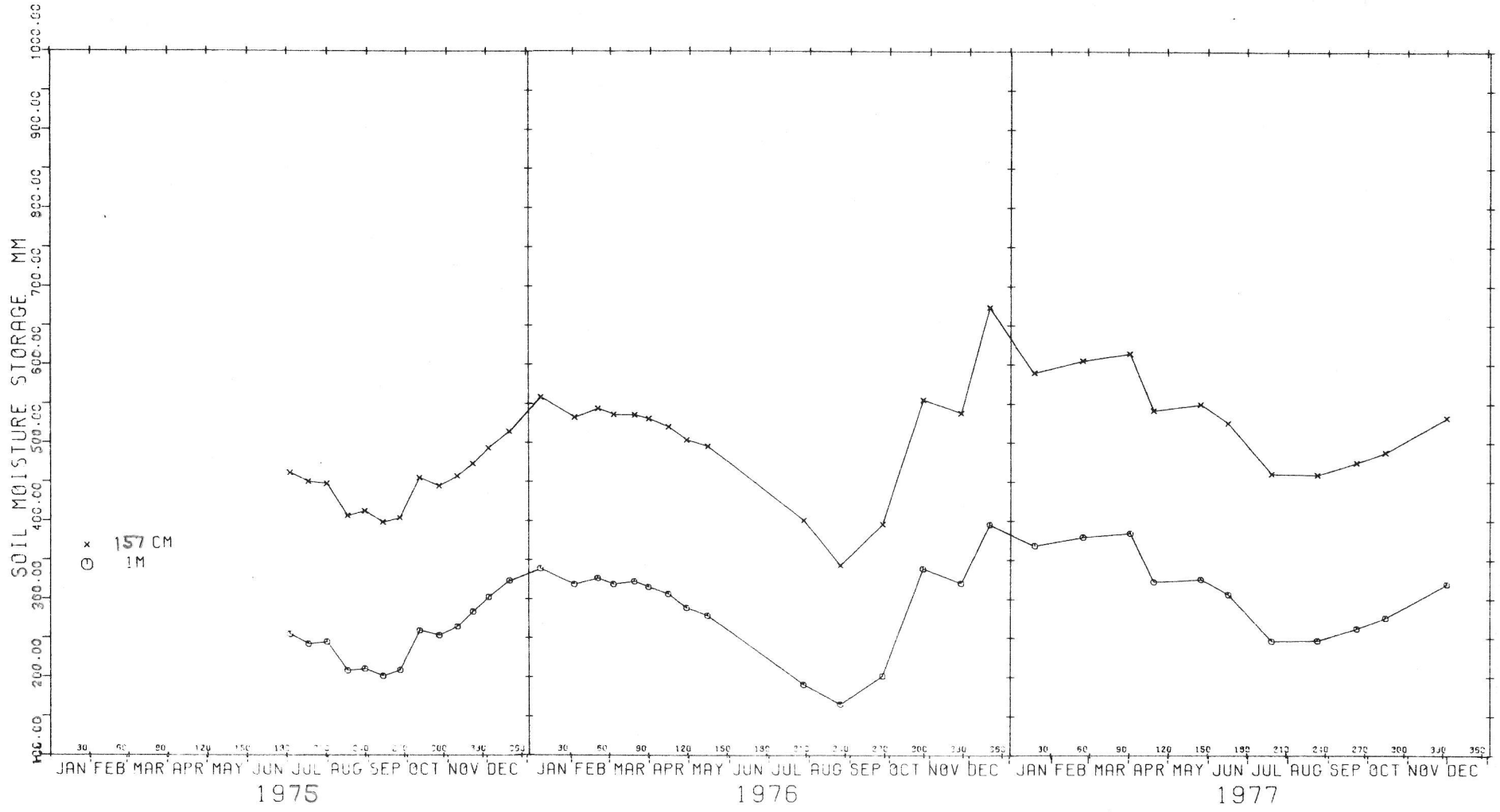


FIGURE 33

Site: F1 **PM Texture:** SANDY ALLUVIUM/ COLLUVIUM **Soil:** GLEYED BROWN EARTH (OLLERTON COMPLEX) **Landuse:** MOWN GRASS

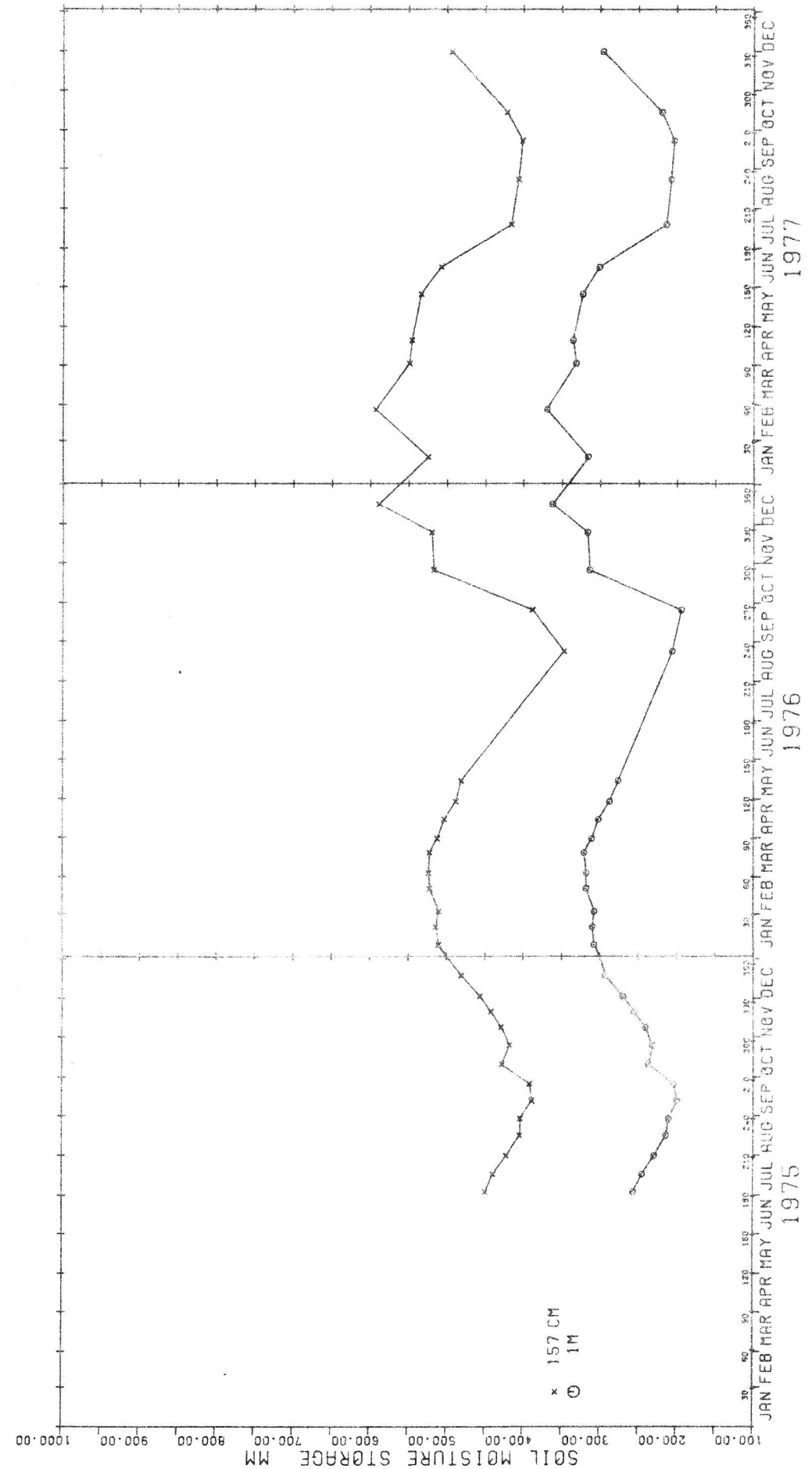


FIGURE 34

Site: F2 **PM Texture:** SANDY ALLUVIUM/ COLLUVIUM **Soil:** GLEYED BROWN EARTH (OLLERTON COMPLEX) **Landuse:** PERMANENT PASTURE

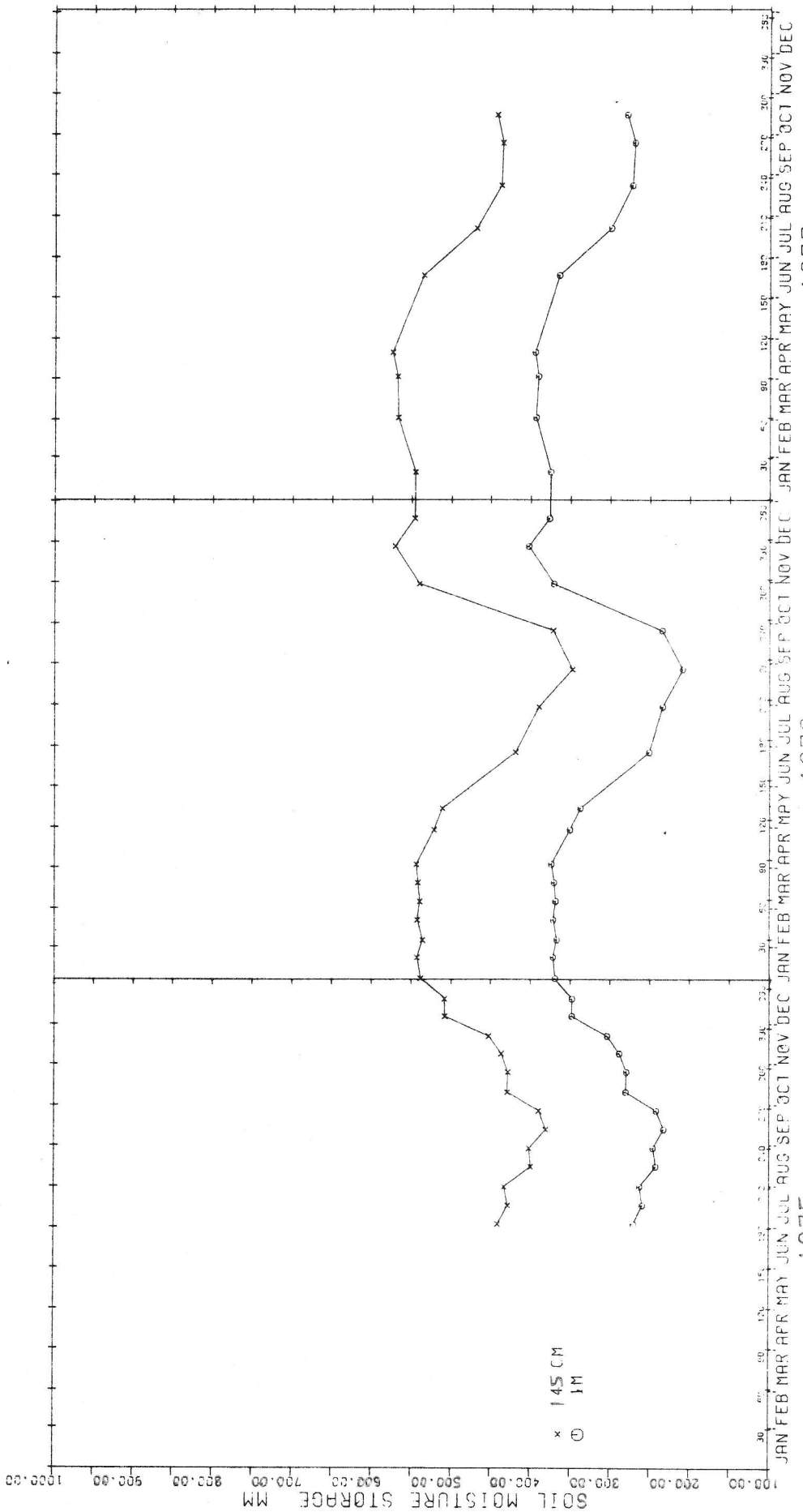


FIGURE 35

Site: F5 **PM Texture:** LOAM **Soil:** GLEYED BROWN EARTH (HODNET) **Landuse:** UNKEMPT GRASS

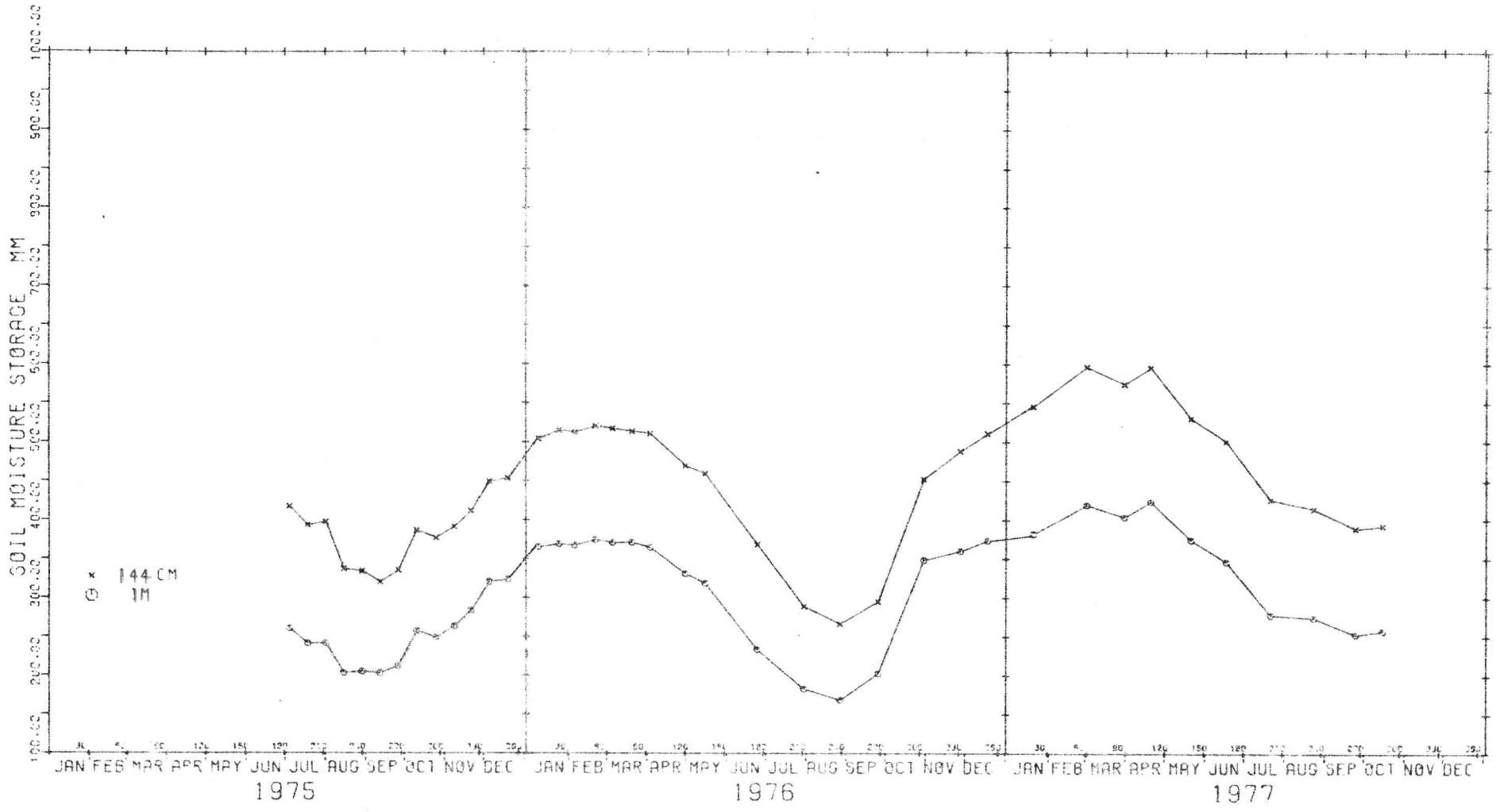


FIGURE 36

Site: F6 **PM TExture:** LOAM **Soil:** GLEYED BROWN EARTH (HODNET) **Landuse:** UNKEMPT GRASS

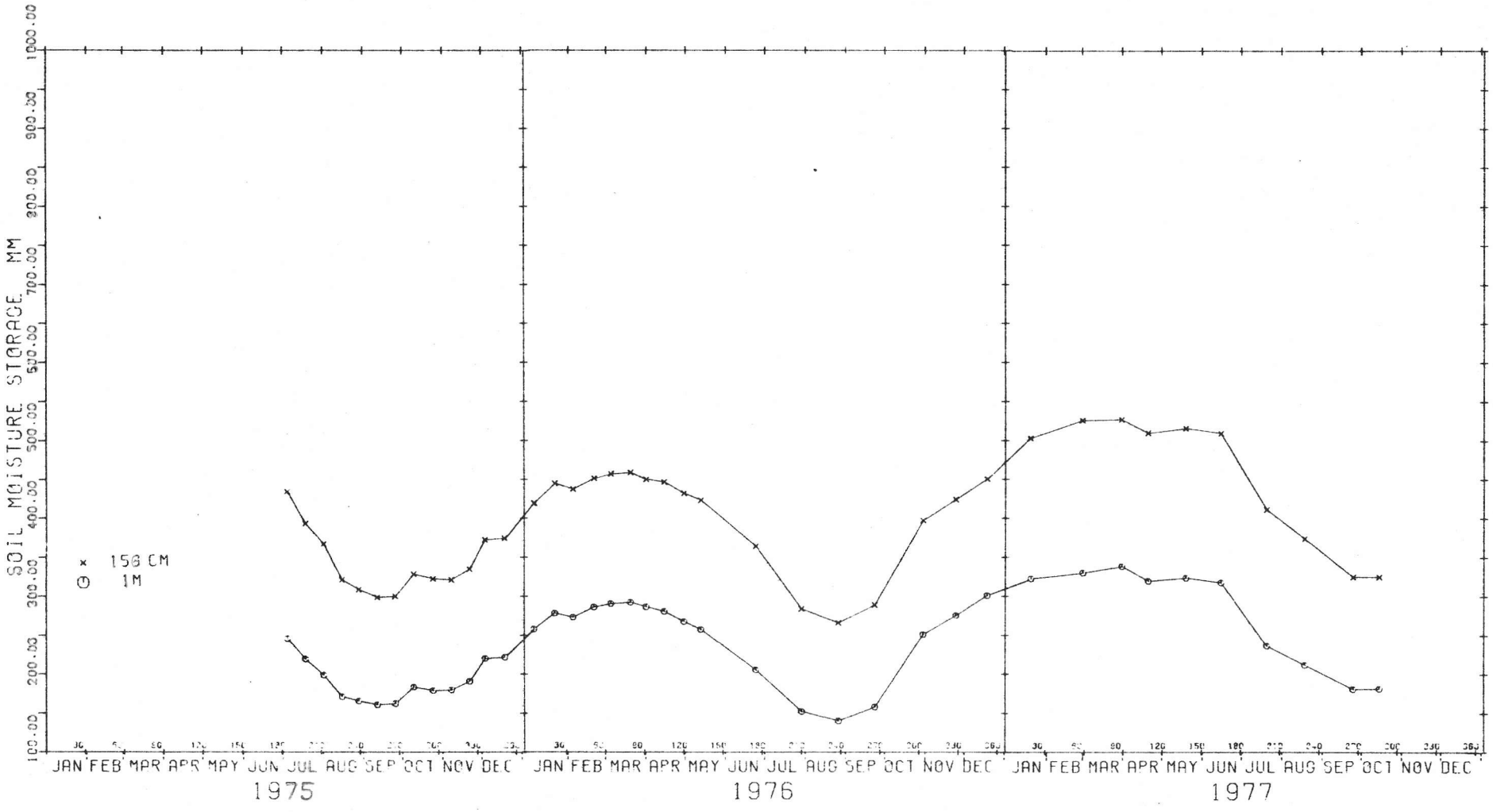


FIGURE 37

Site: F8 **PM Texture:** LOAM **Soil:** GLEYED BROWN EARTH (HODNET) **Landuse:** WOODLAND

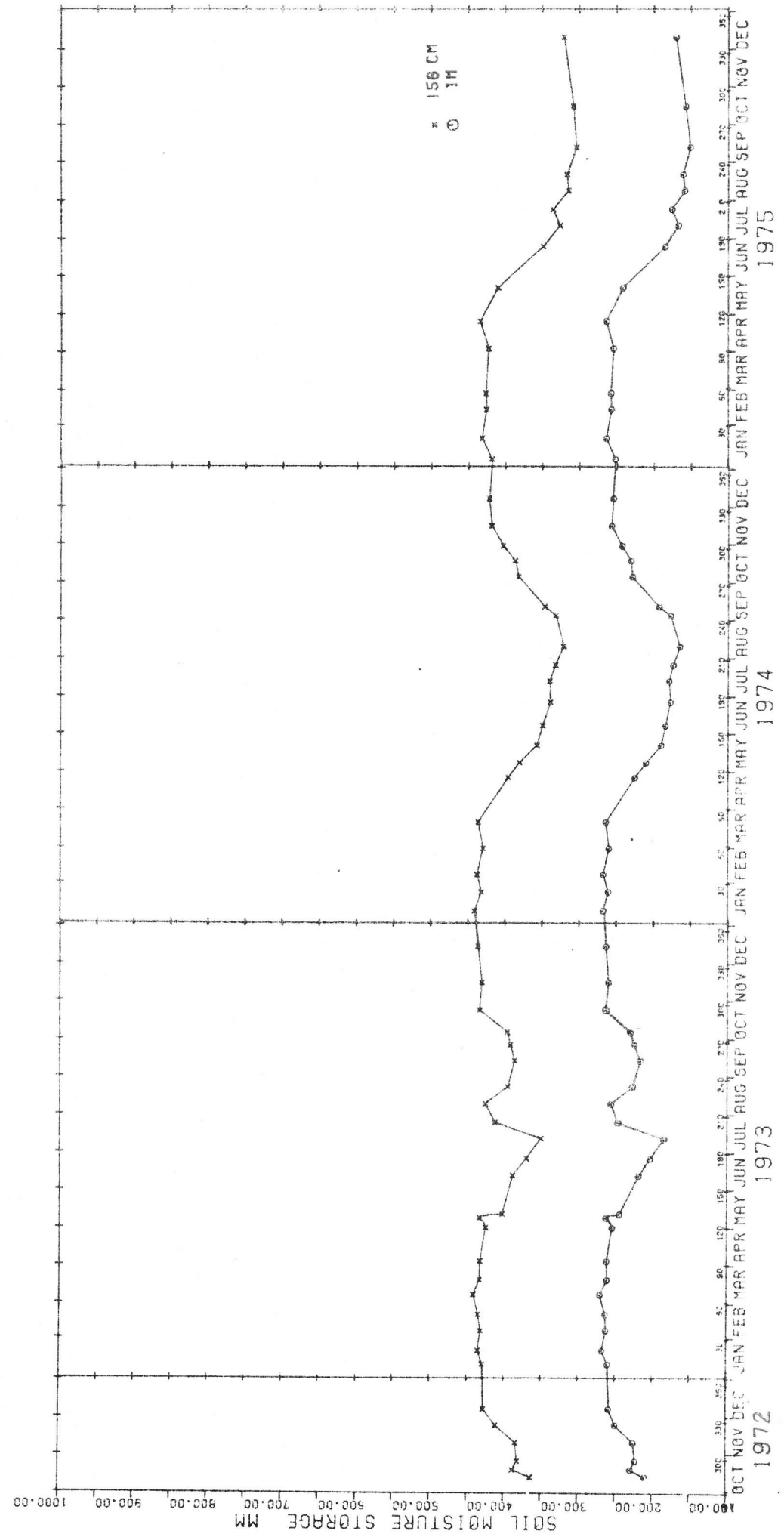


FIGURE 38

Site: H3 **PM Texture:** LOAMY DRIFT **Soil:** GLEYED BROWN EARTH (SALWICK) **Landuse:** MOWN GRASS

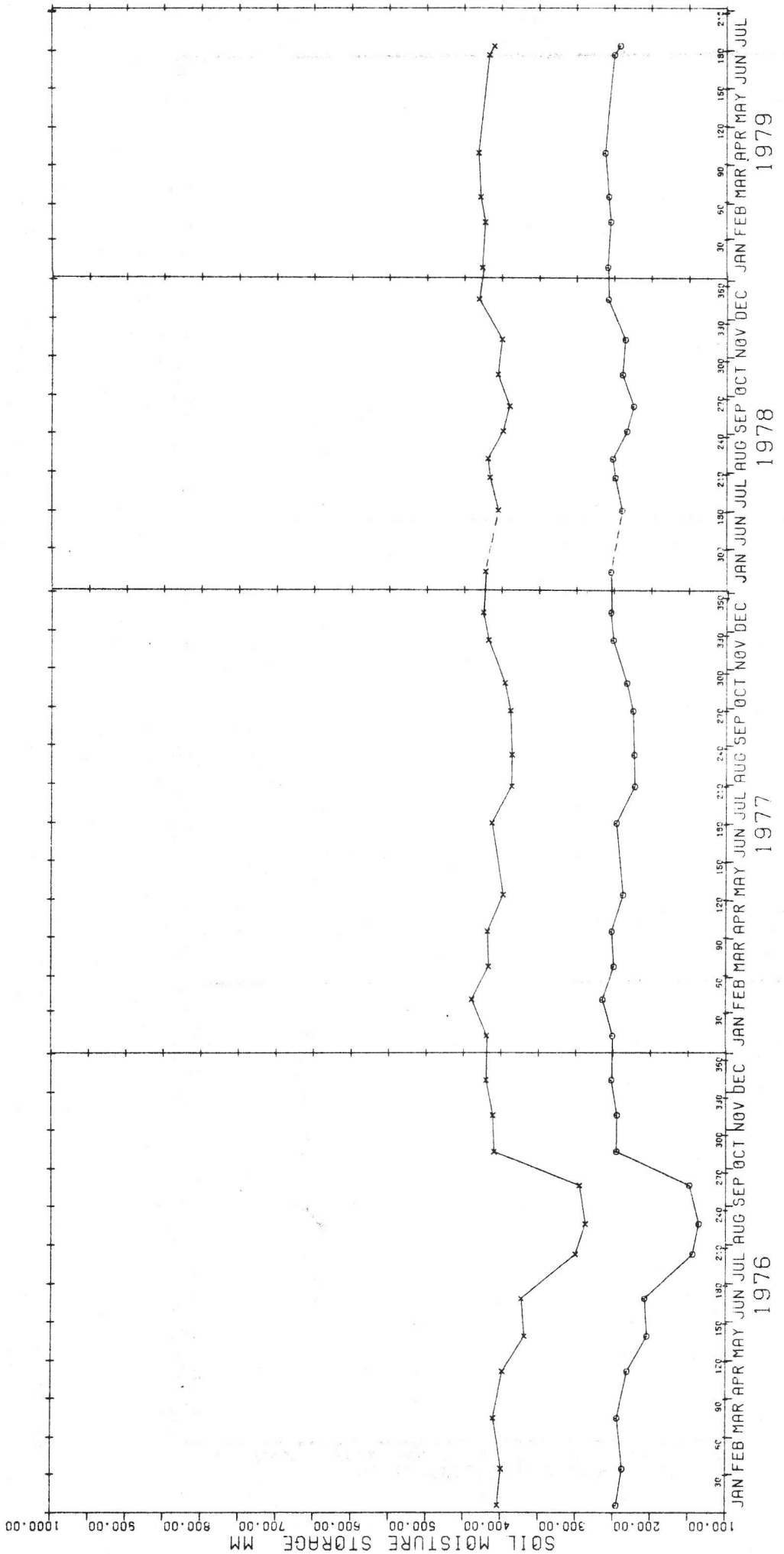


FIGURE 38 (Contd.)

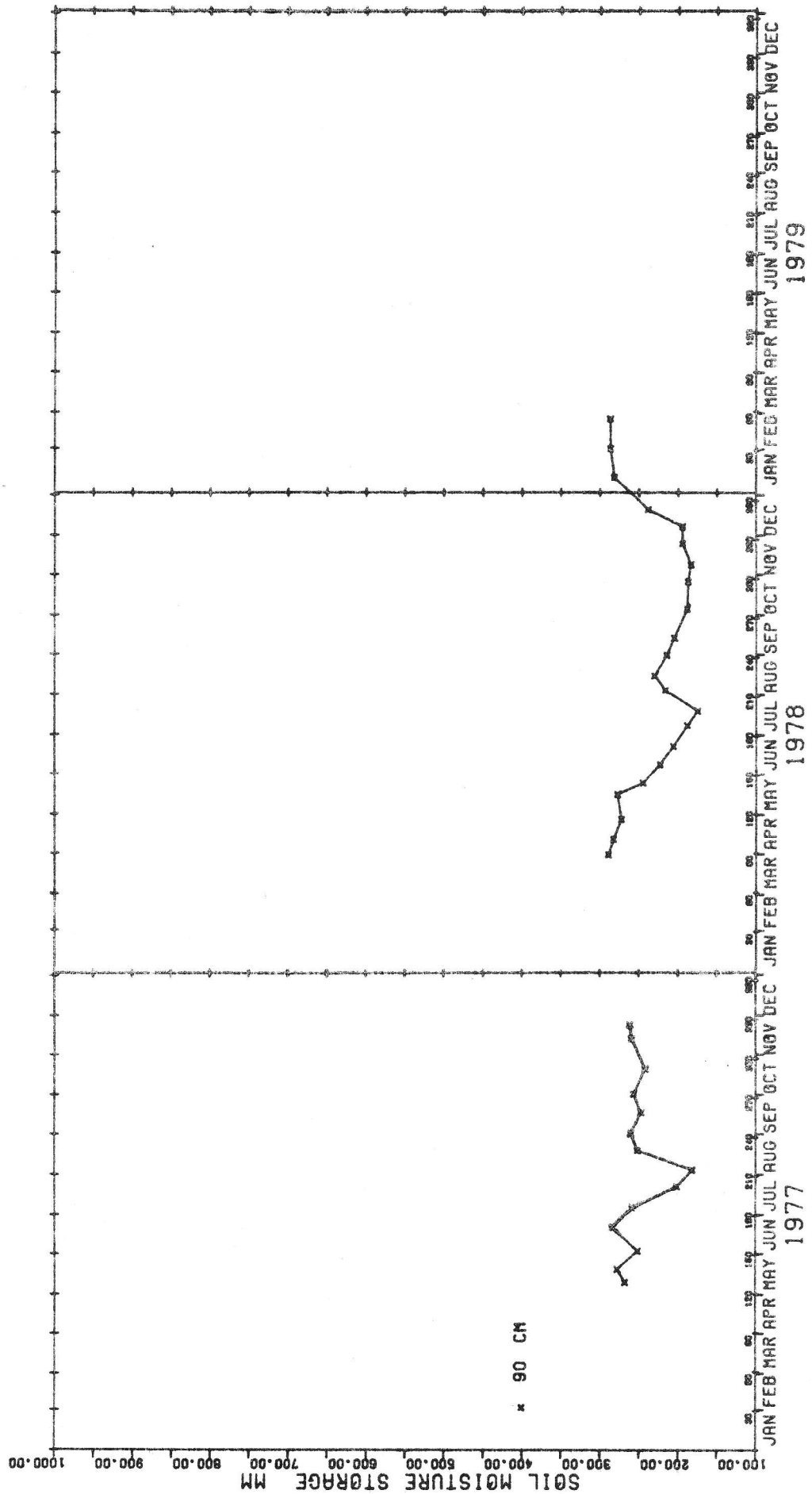


FIGURE 39

Site: N2 PM Texture: LOAMY DRIFT Soil: GLEYED BROWN EARTH (WHIMPLE) Landuse: PERMANENT PASTURE

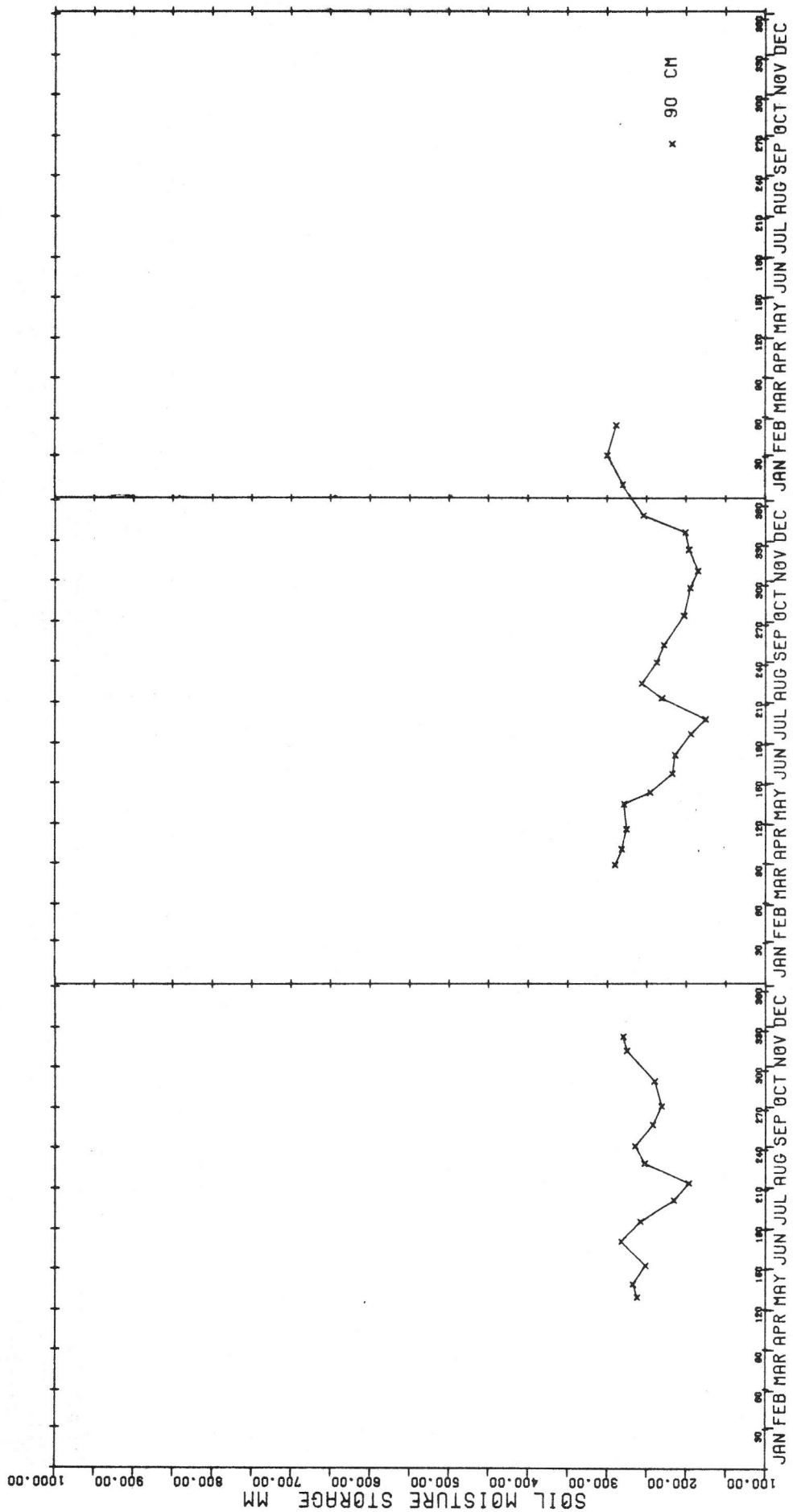


FIGURE 40

Site: N3 PM Texture: LOAMY DRIFT Soil: GLEYED BROWN EARTH (WHIMPLE) Landuse: PERMANENT PASTURE

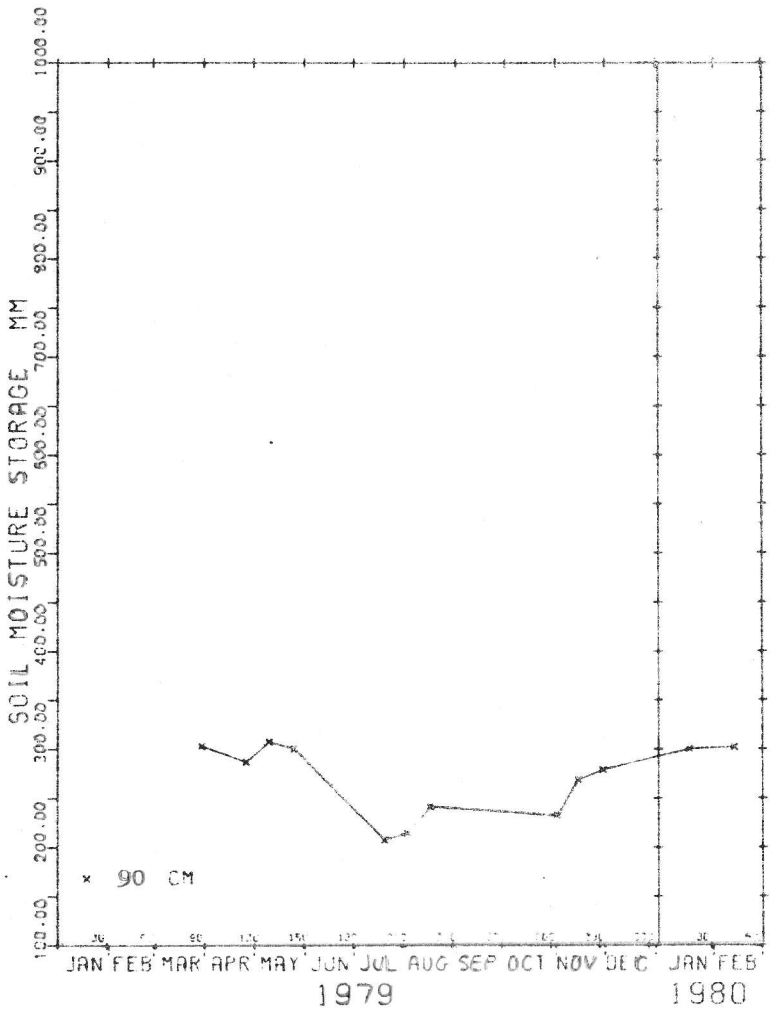


FIGURE 41a

Site: N11
PM Texture: LOAMY DRIFT
Soil: GLEYED BROWN EARTH (WHIMPLE)
Landuse: WINTER WHEAT

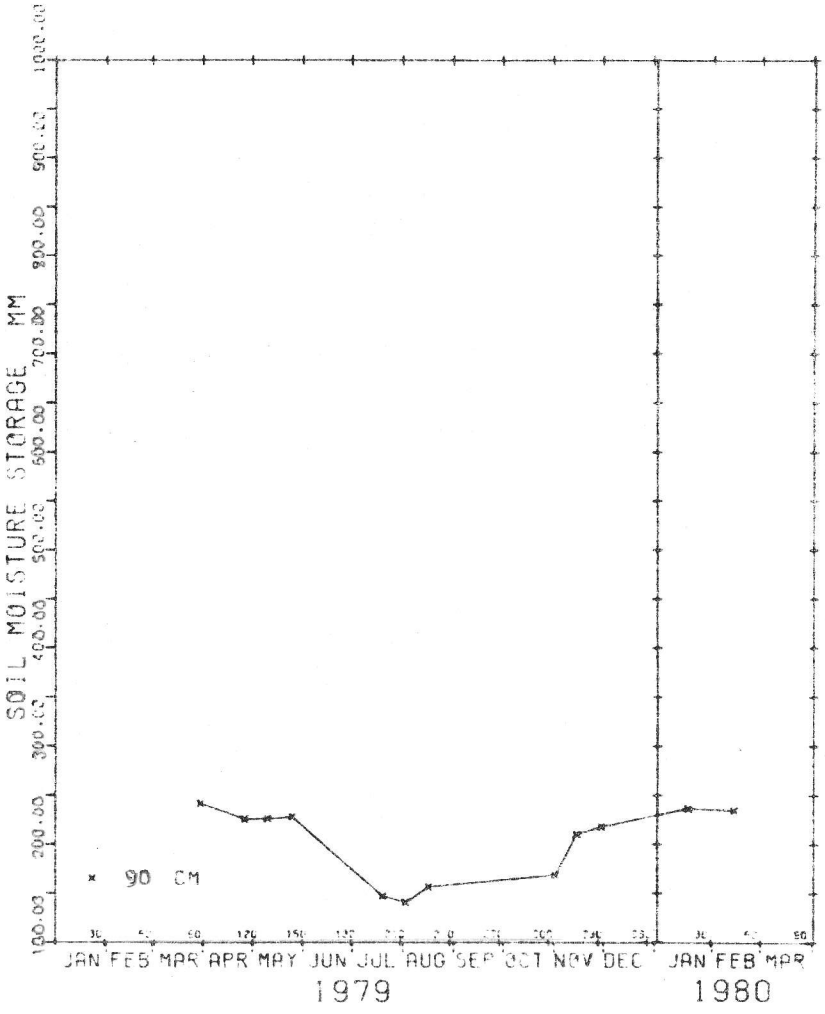


FIGURE 41b

Site: N14
PM Texture: LOAMY TERRACE DEPOSITS
Soil: GLEYED BROWN EARTH (RUSHWICK)
Landuse: WINTER WHEAT

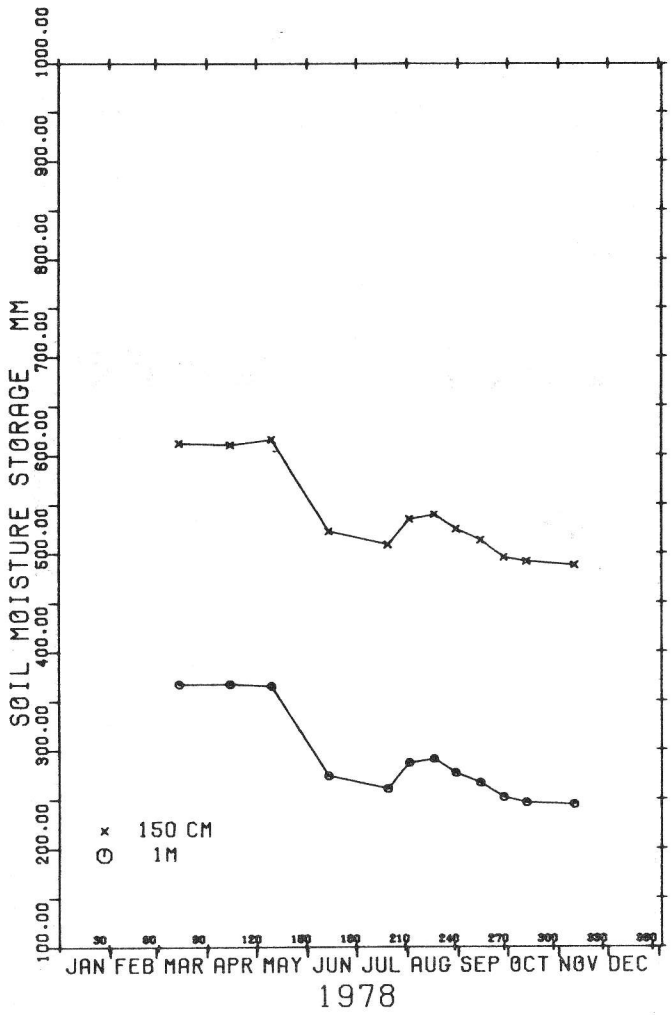


FIGURE 42a

Site: N1
PM Texture: LOAMY DRIFT
Soil: GLEYED BROWN EARTH
(LANGFORD OR TAUNTON)
Landuse: GRASS

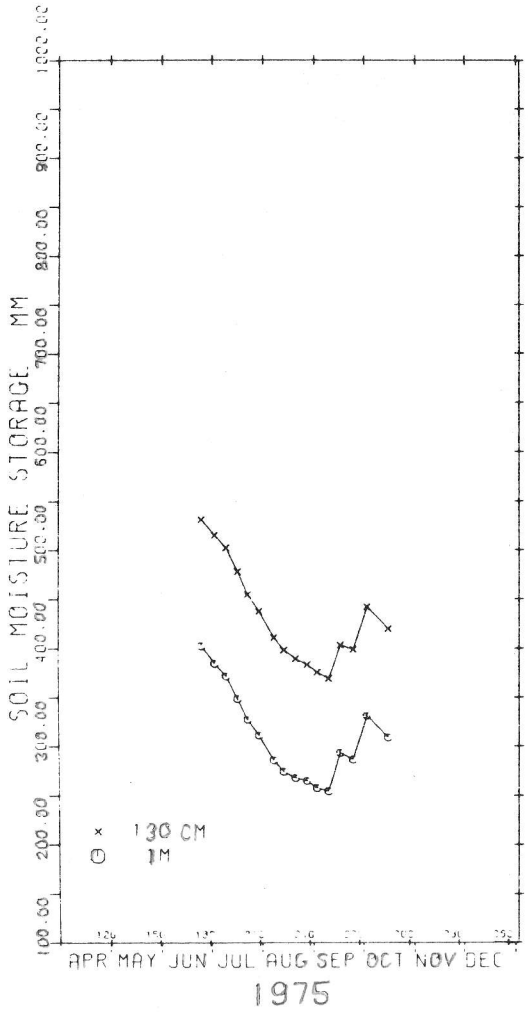


FIGURE 42b

Site: J1
PM Texture: LOAMY DRIFT
Soil: GLEYED BROWN EARTH
(MOULTON OR ASHLEY)
Landuse: SUGAR BEET

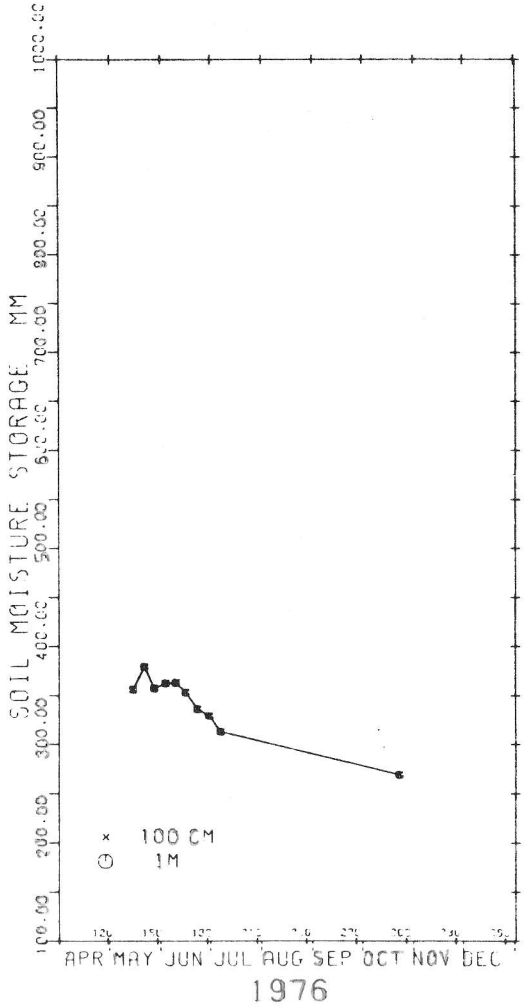


FIGURE 42c

Site: J2
PM Texture: LOAMY DRIFT
Soil: GLEYED BROWN EARTH
(WICKMERE)
Landuse: CABBAGES

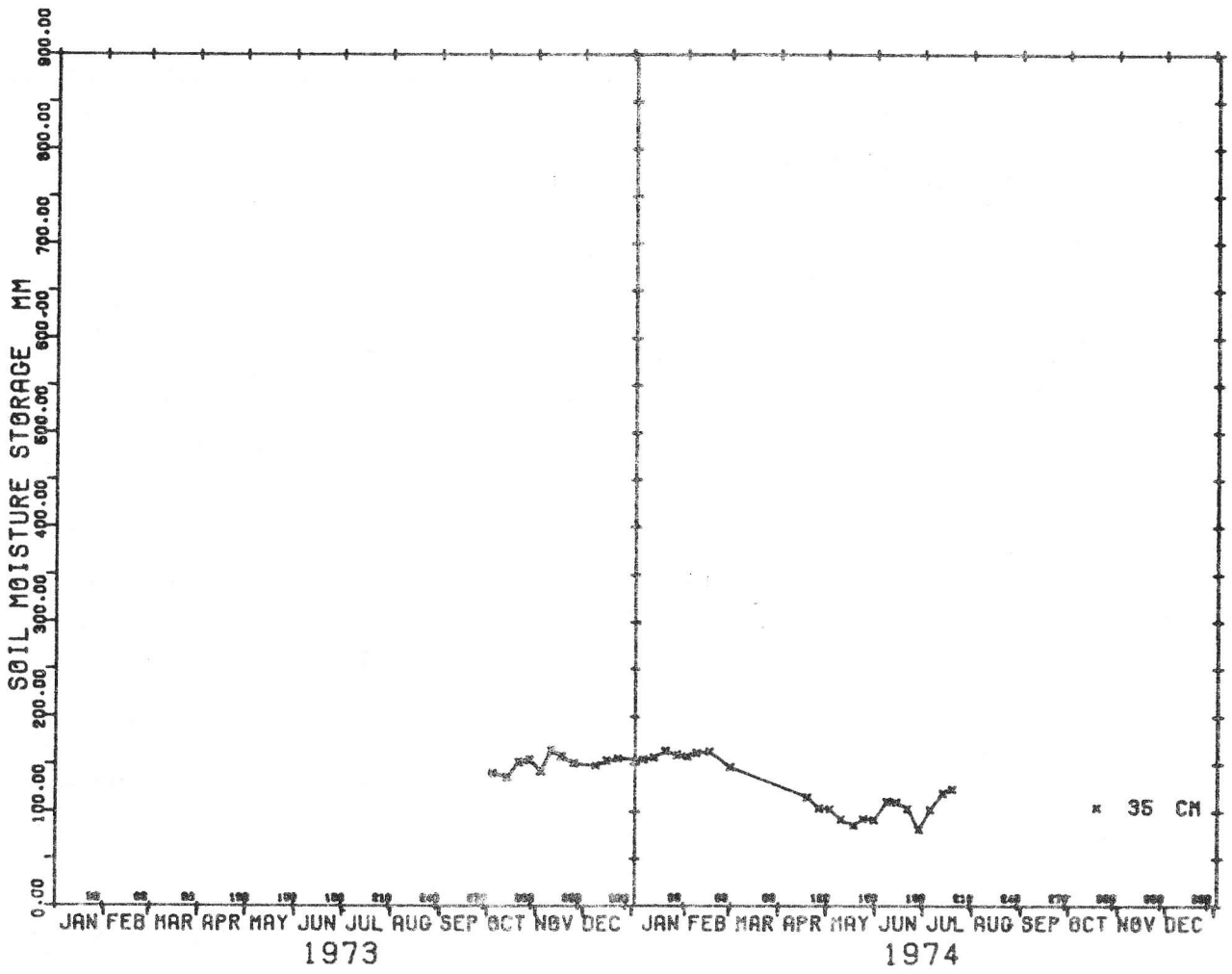


FIGURE 43

Site: D1 PM Texture: SANDY CLAY DRIFT Soil: GLEYED BROWN EARTH (BRANTWOOD ASSOCIATION) Landuse: ROUGH GRAZING

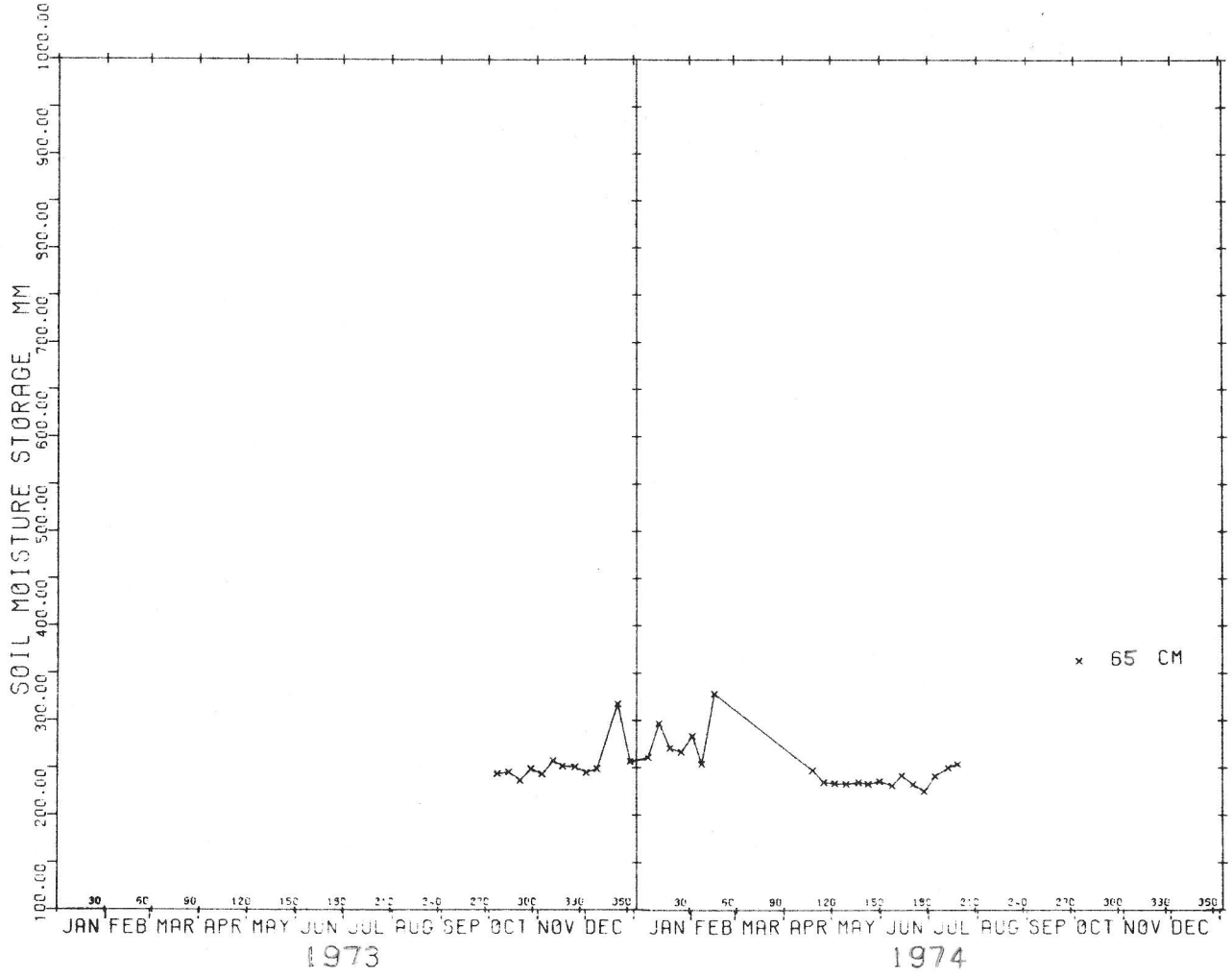


FIGURE 44

Site: D6 PM Texture: SANDY CLAY DRIFT Soil: GLEYED BROWN EARTH (RIVINGTON ASSOCIATION Landuse: ROUGH GRAZING (Heather Moor)

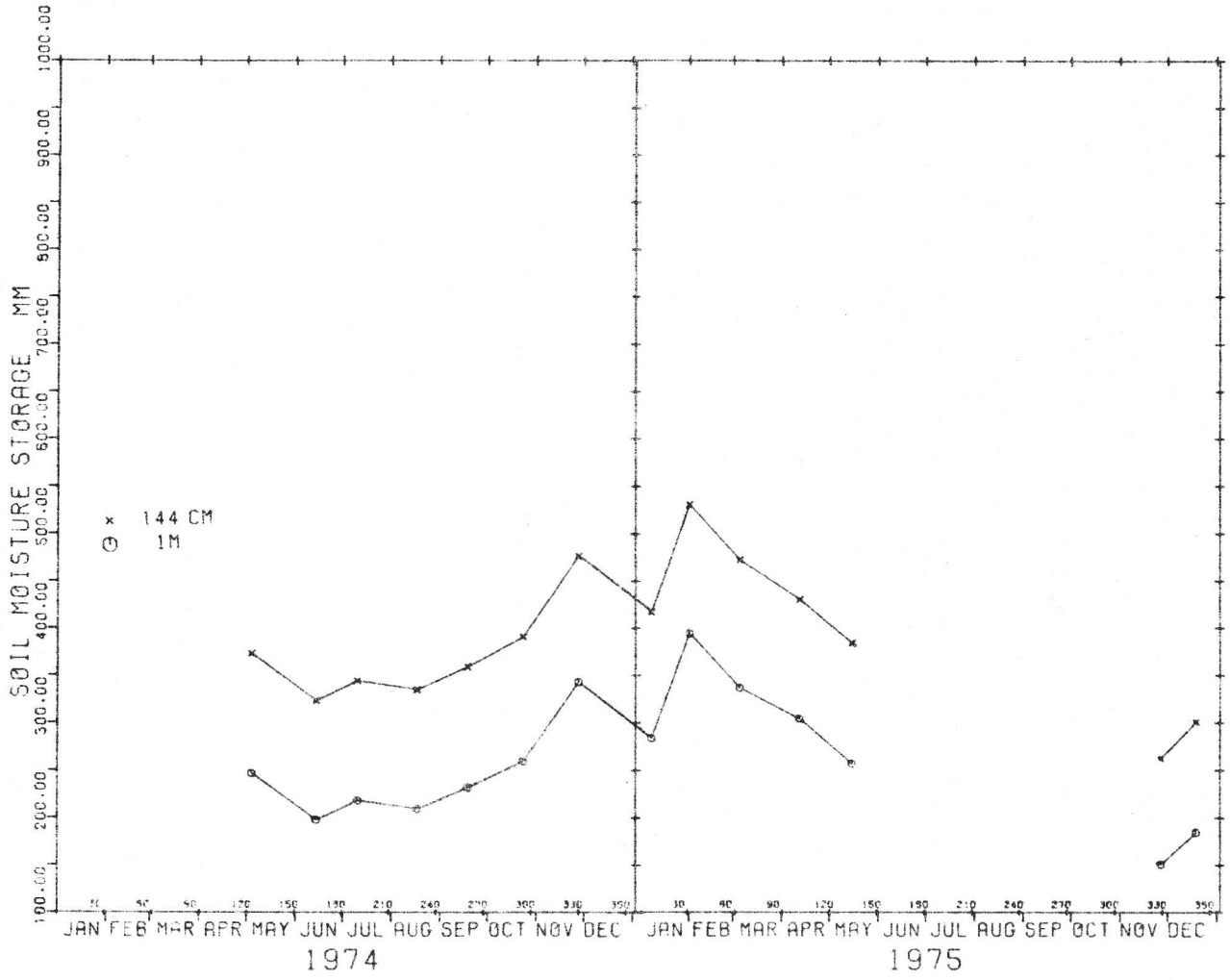


FIGURE 45

Site: M2 **PM Texture:** LOAMY DRIFT OVER CLAY **Soil:** GLEYED BROWN EARTH (ISLE ABBOTS) **Landuse:** PERMANENT PASTURE

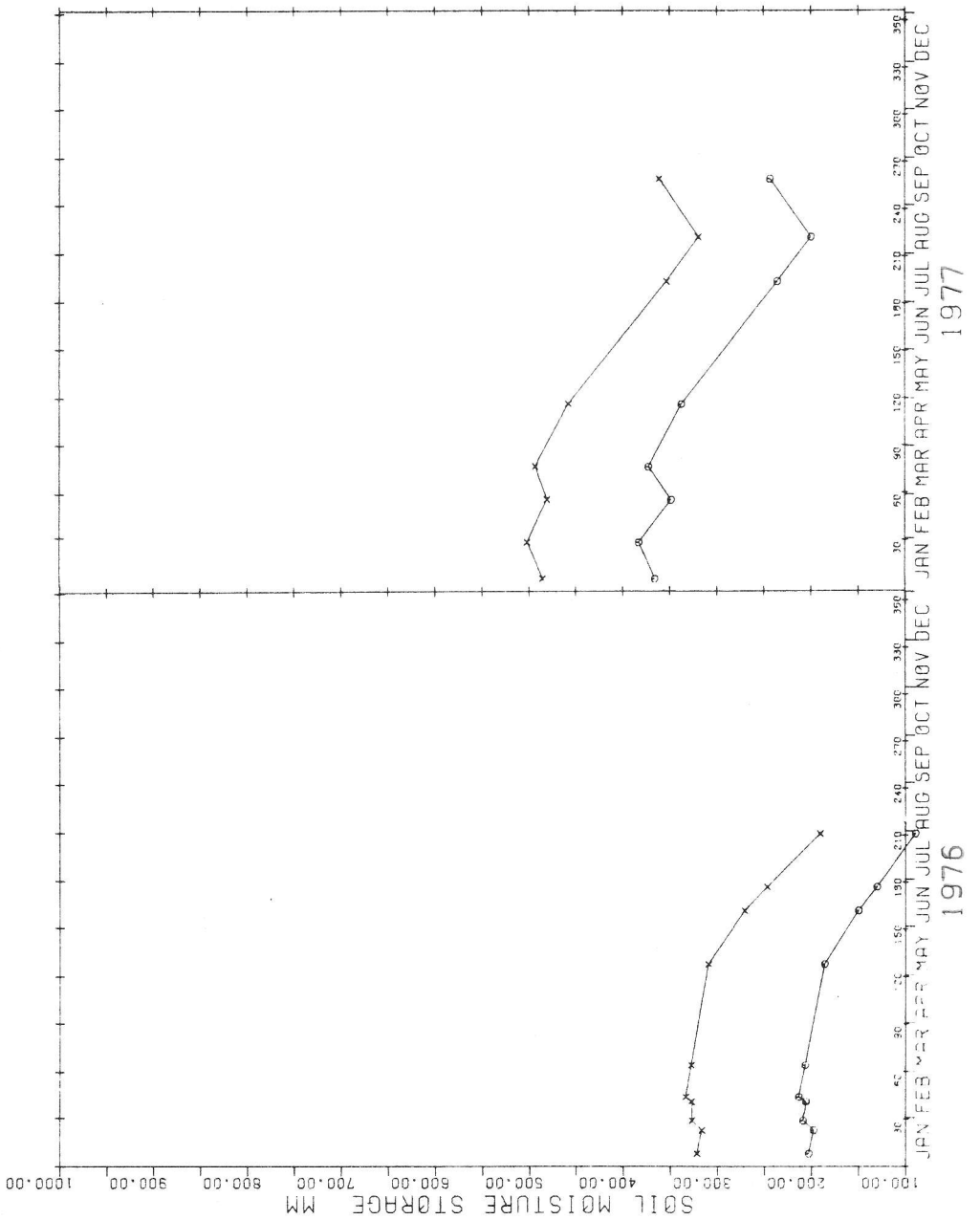


FIGURE 45 (Contd.)

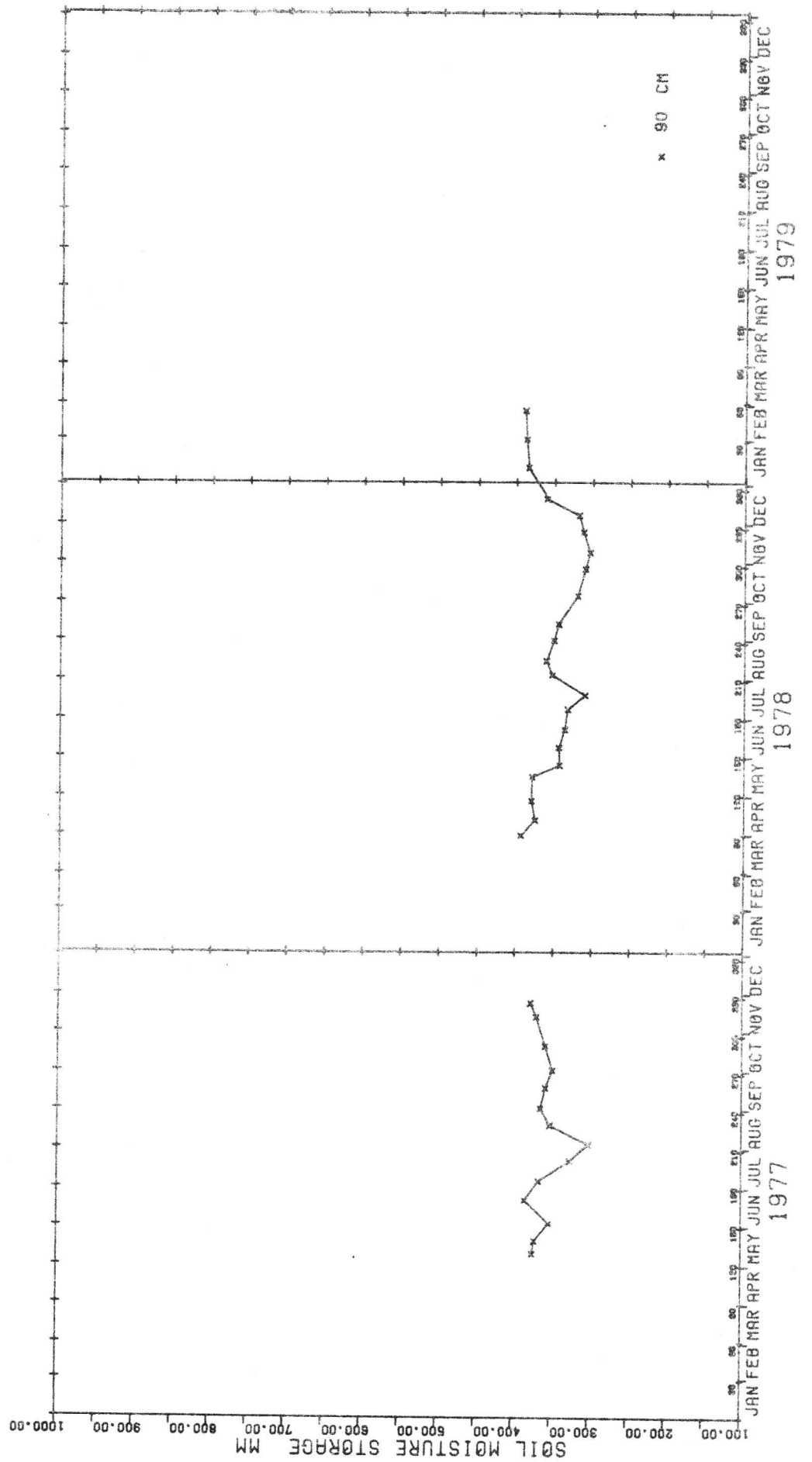


FIGURE 46

Site: N4 PM Texture: CLAYEY (KEUPER MARL) Soil: GLEYED BROWN EARTH (WORCESTER) Landuse: PERMANENT PASTURE

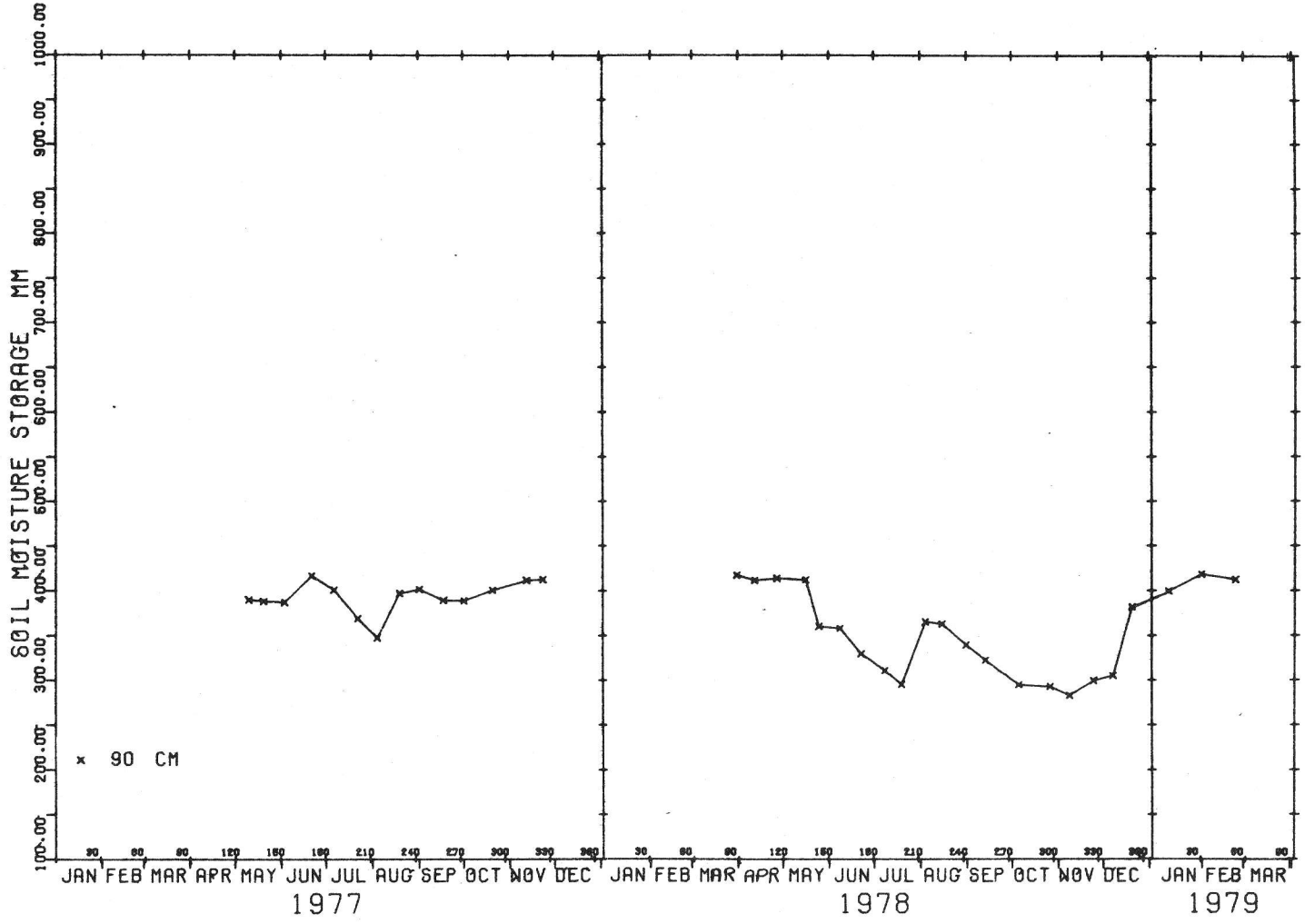


FIGURE 47

Site: N5 PM Texture: CLAYEY (KEUPER MARL) Soil: GLEYED BROWN EARTH (WORCESTER) Landuse: PERMANENT PASTURE

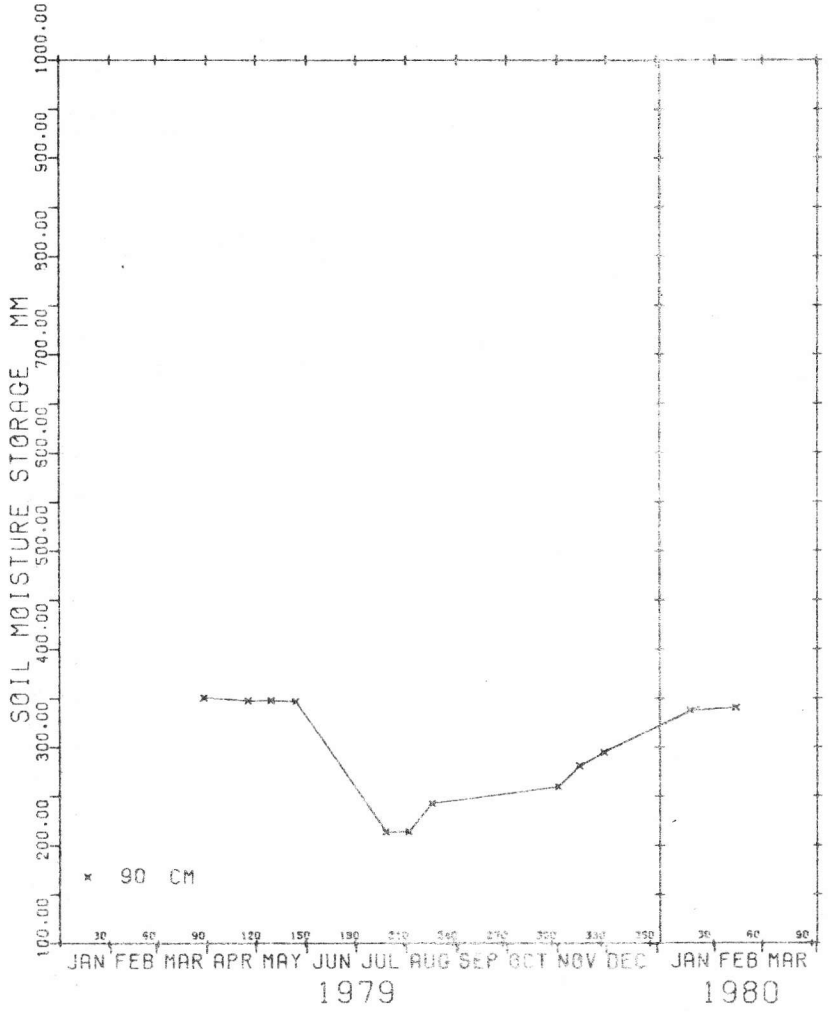


FIGURE 48a

Site: N12
PM Texture: CLAYEY (KEUPER MARL)
Soil: GLEYED BROWN EARTH (WORCESTER)
Landuse: WINTER WHEAT

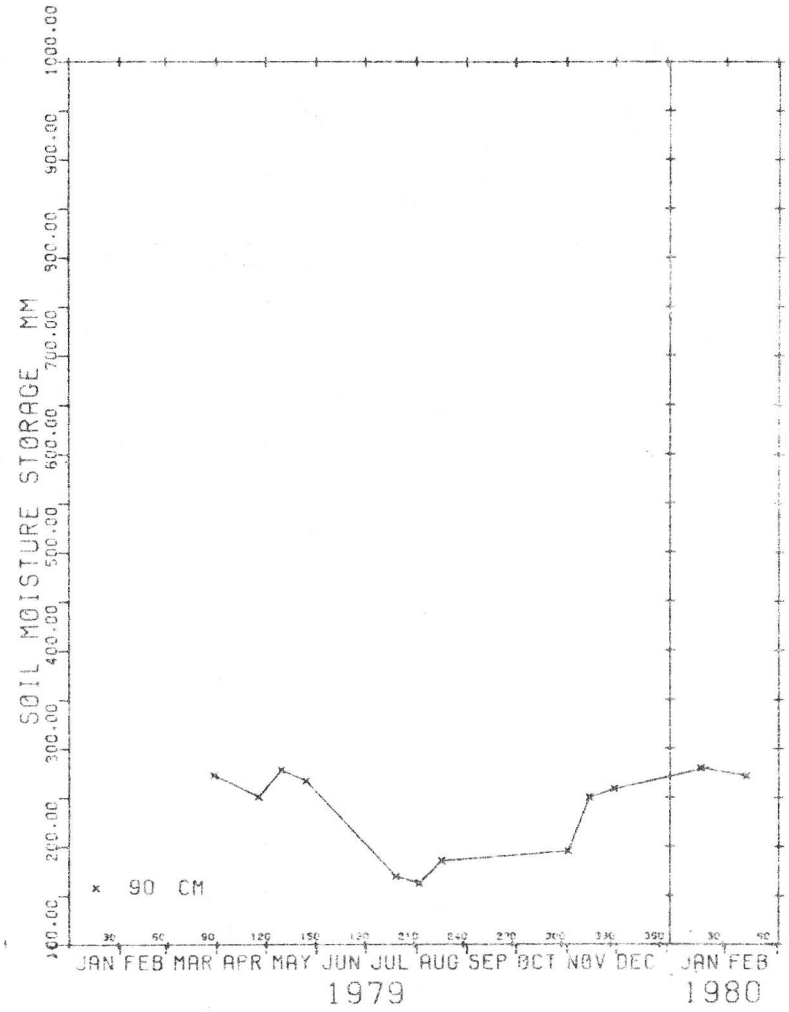


FIGURE 48b

Site: N13
PM Texture: LOAMY DRIFT OVER KEUPER MARL
Soil: GLEYED BROWN EARTH (DUNNINGTON HEATH)
Landuse: WINTER WHEAT

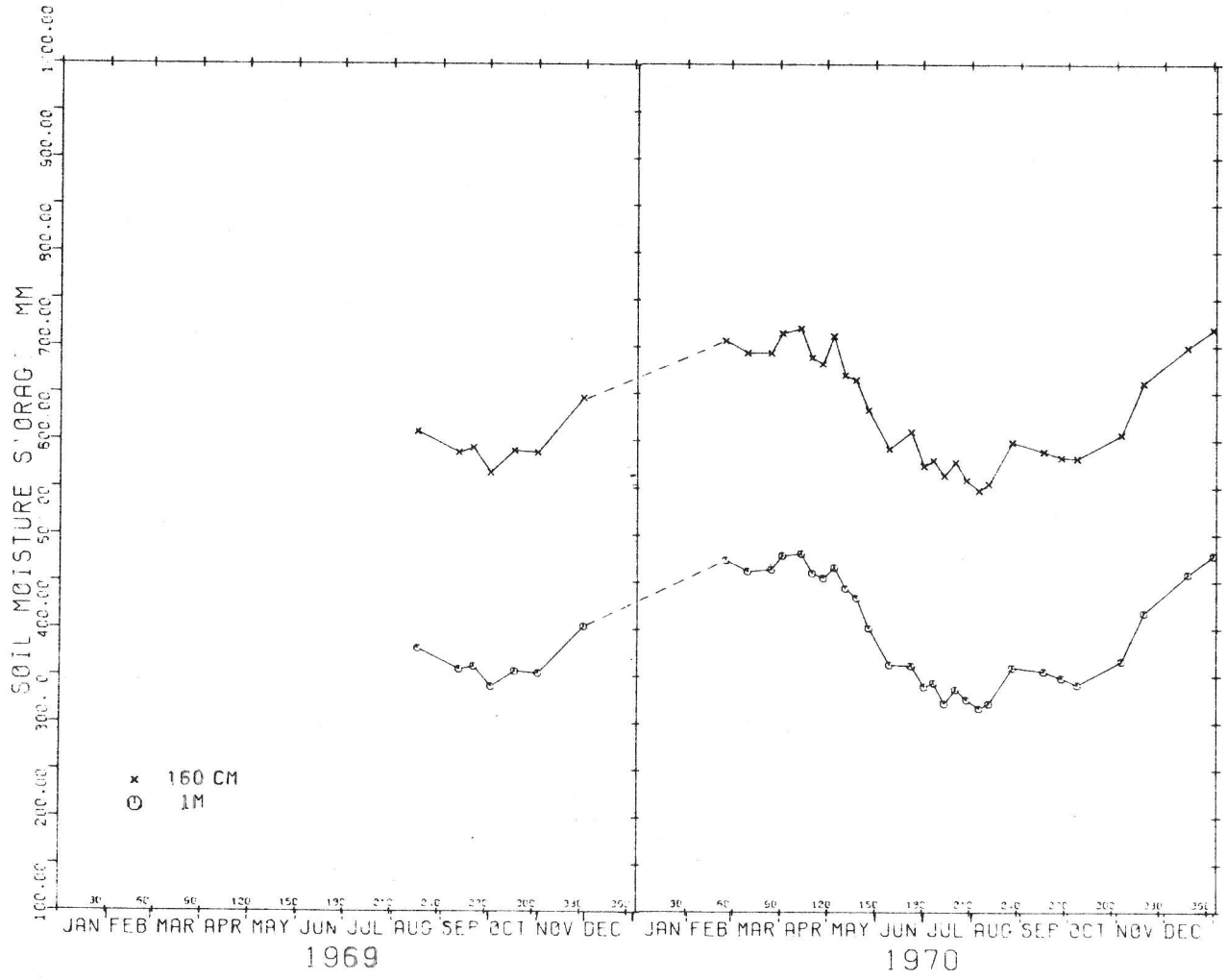


FIGURE 49

Site: T1 PM Texture: CLAY Soil: GLEYED BROWN EARTH (EVESHAM) Landuse: MOWN GRASS

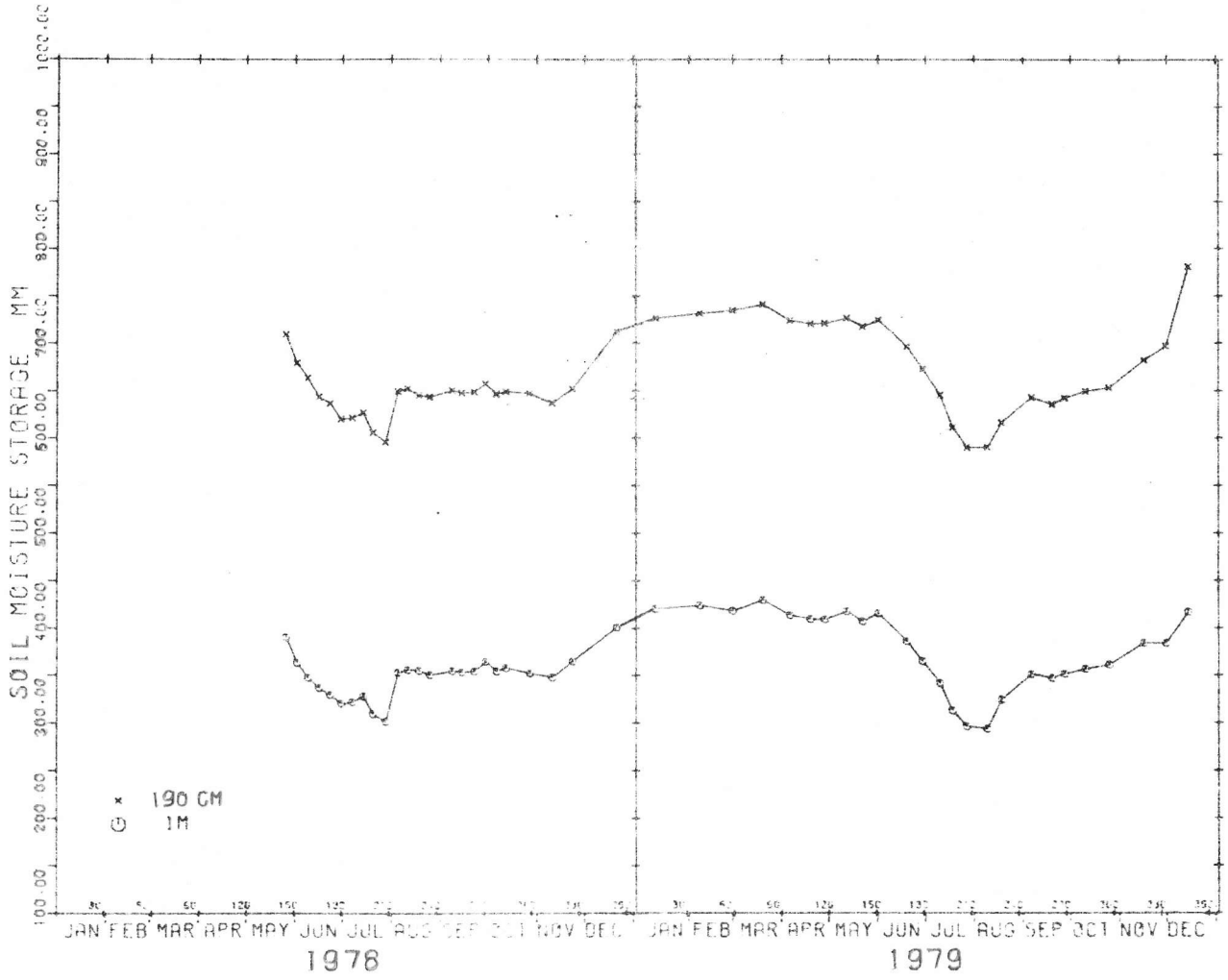


FIGURE 50

Site: Q1 **PM Texture:** CLAY **Soil:** GLEYED BROWN EARTH (EVESHAM) **Landuse:** WINTER WHEAT

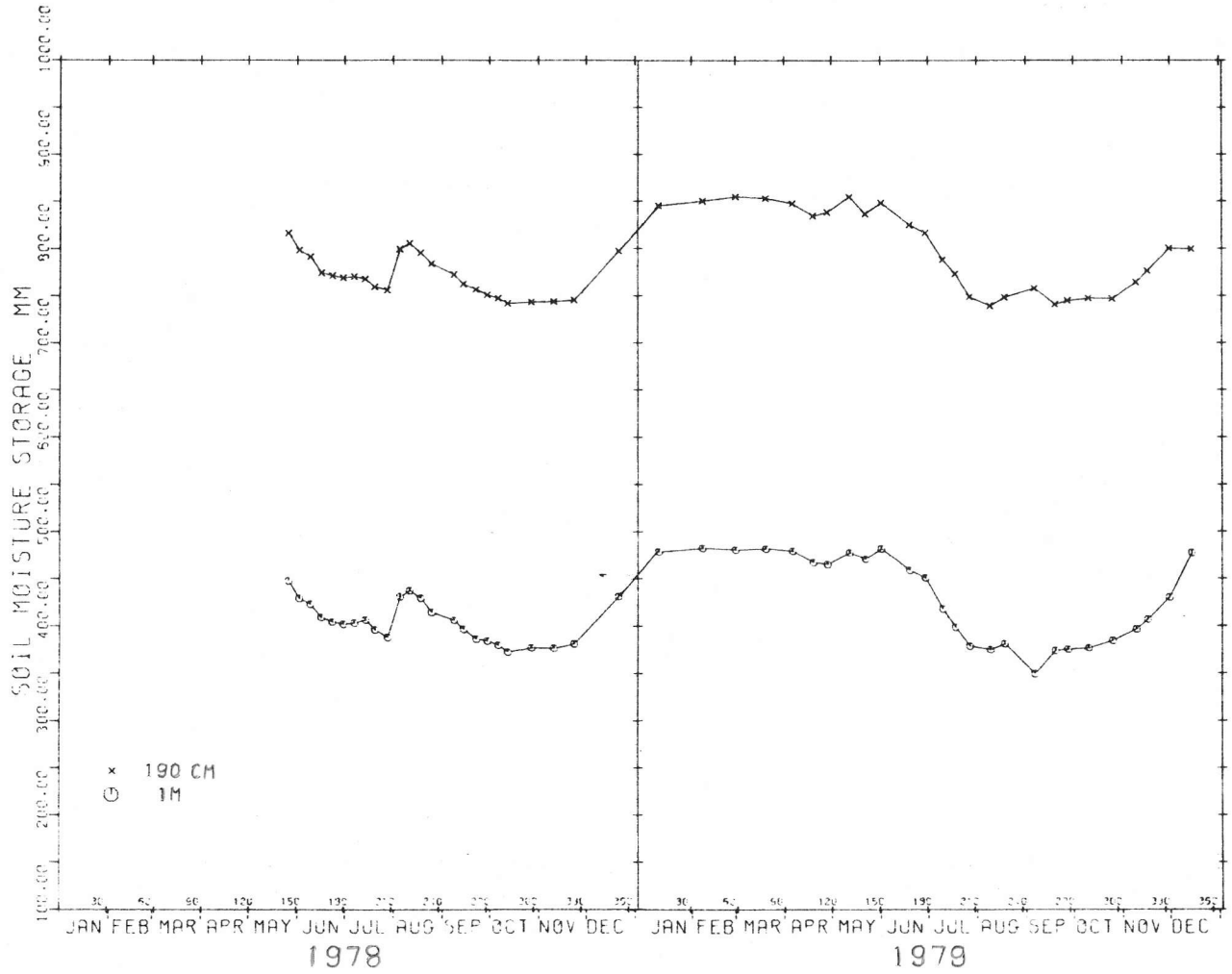


FIGURE 51

Site: Q3 **PM Texture:** CLAY **Soil:** GLEYED BROWN EARTH (EVESHAM) **Landuse:** PERMANENT PASTURE

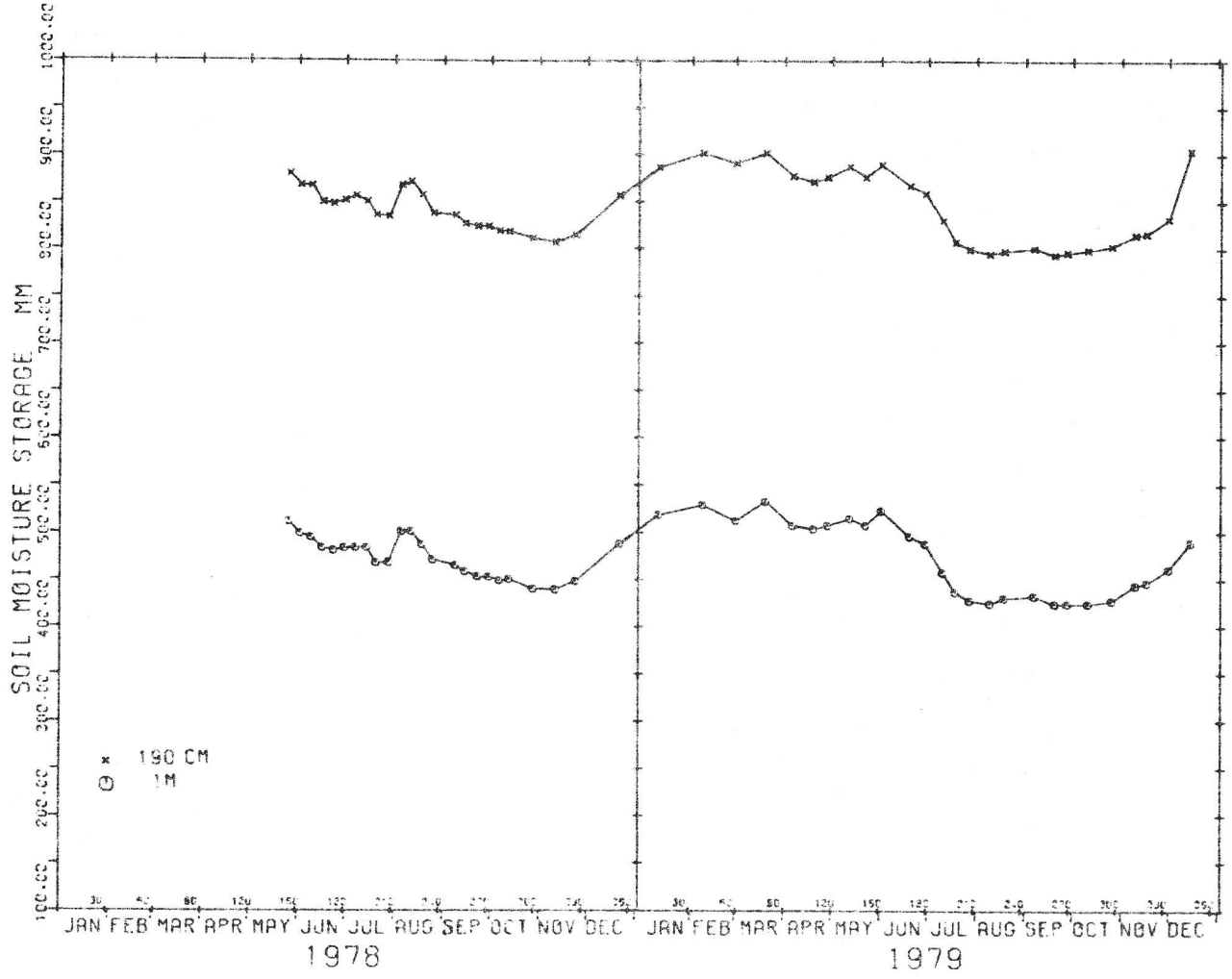


FIGURE 52

Site: Q4 **PM Texture:** CLAY **Soil:** GLEYED BROWN EARTH (EVESHAM) **Landuse:** PERMANENT PASTURE

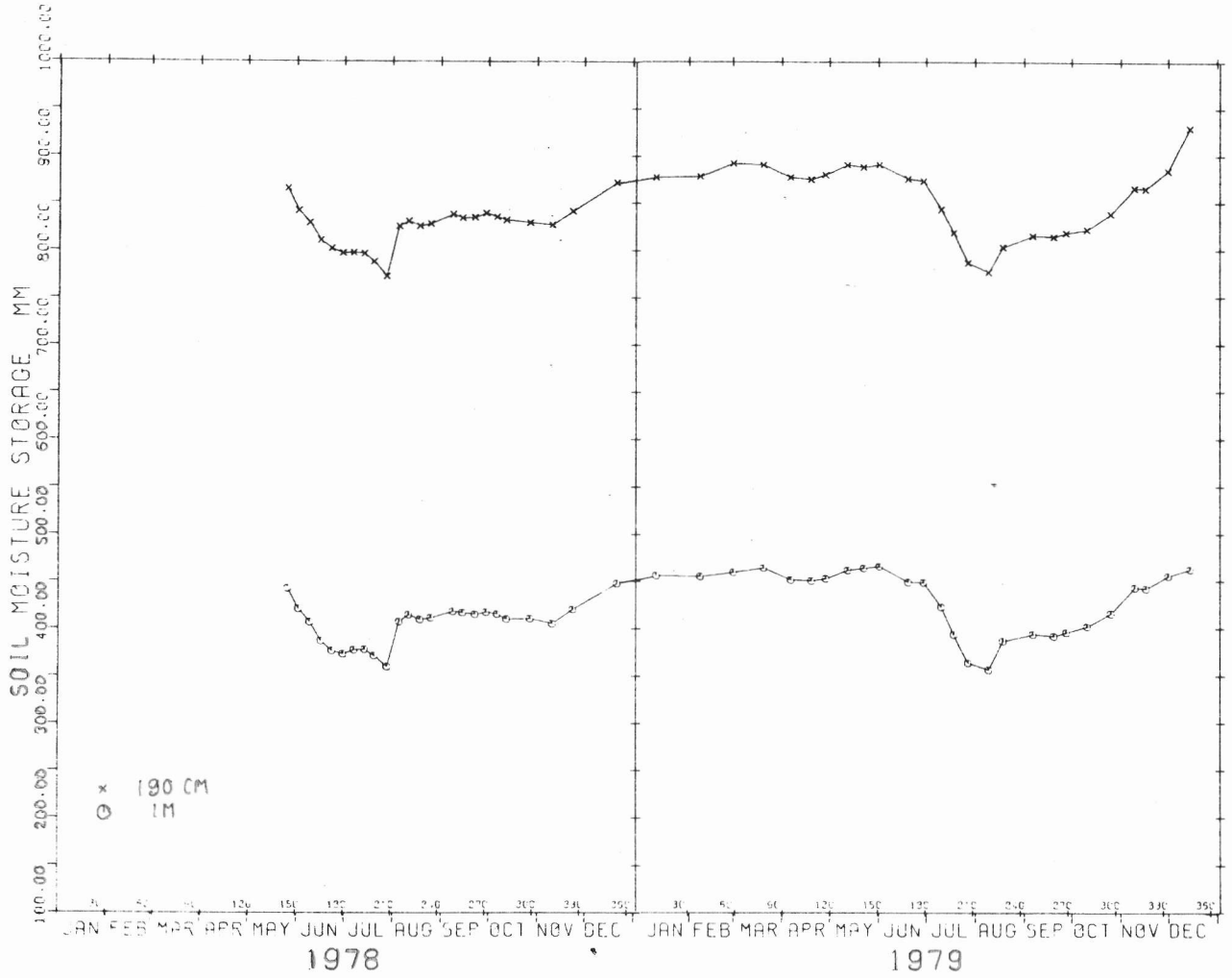


FIGURE 53

Site: Q6 PM Texture: CLAY Soil: GLEYED BROWN EARTH (EVESHAM) Landuse: SPRING BARLEY

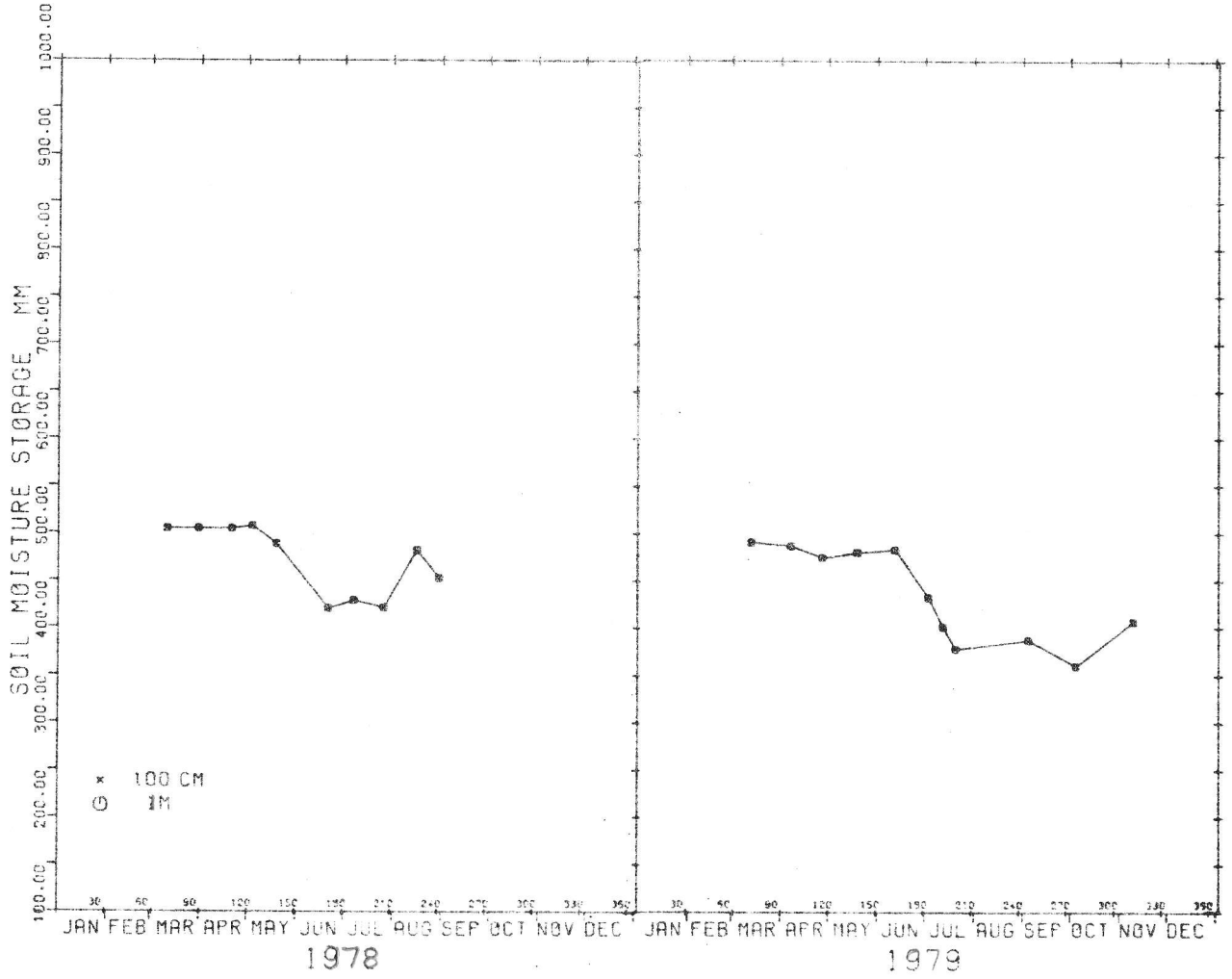


FIGURE 54

Site: I2 **PM Texture:** CLAY **Soil:** GLEYED BROWN EARTH (EVESHAM) **Landuse:** TEMPORARY GRASS

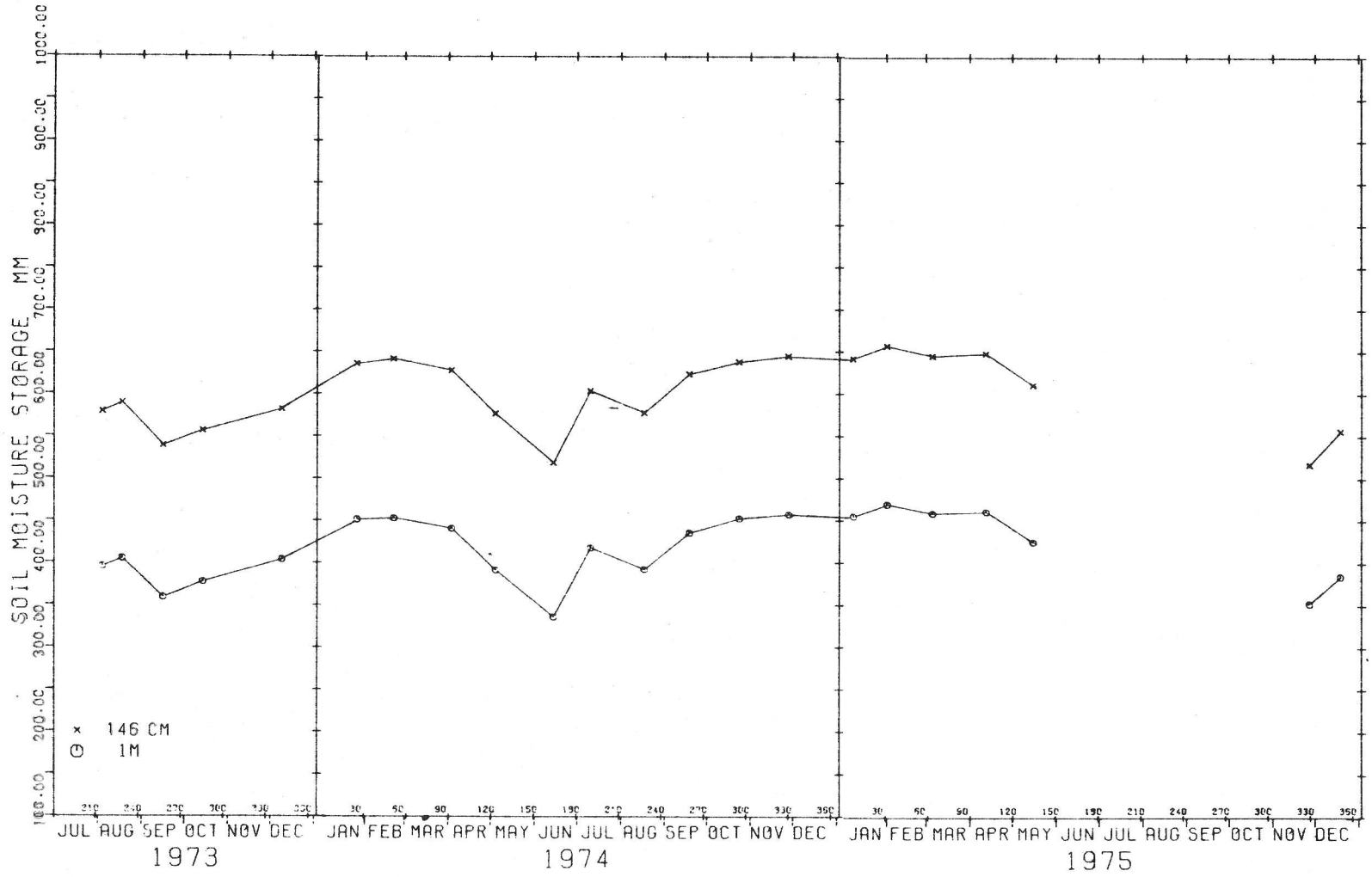


FIGURE 55

Site: M1 **PM Texture:** CLAY DRIFT **Soil:** GLEYED BROWN EARTH (PODIMORE) **Landuse:** PERMANENT PASTURE

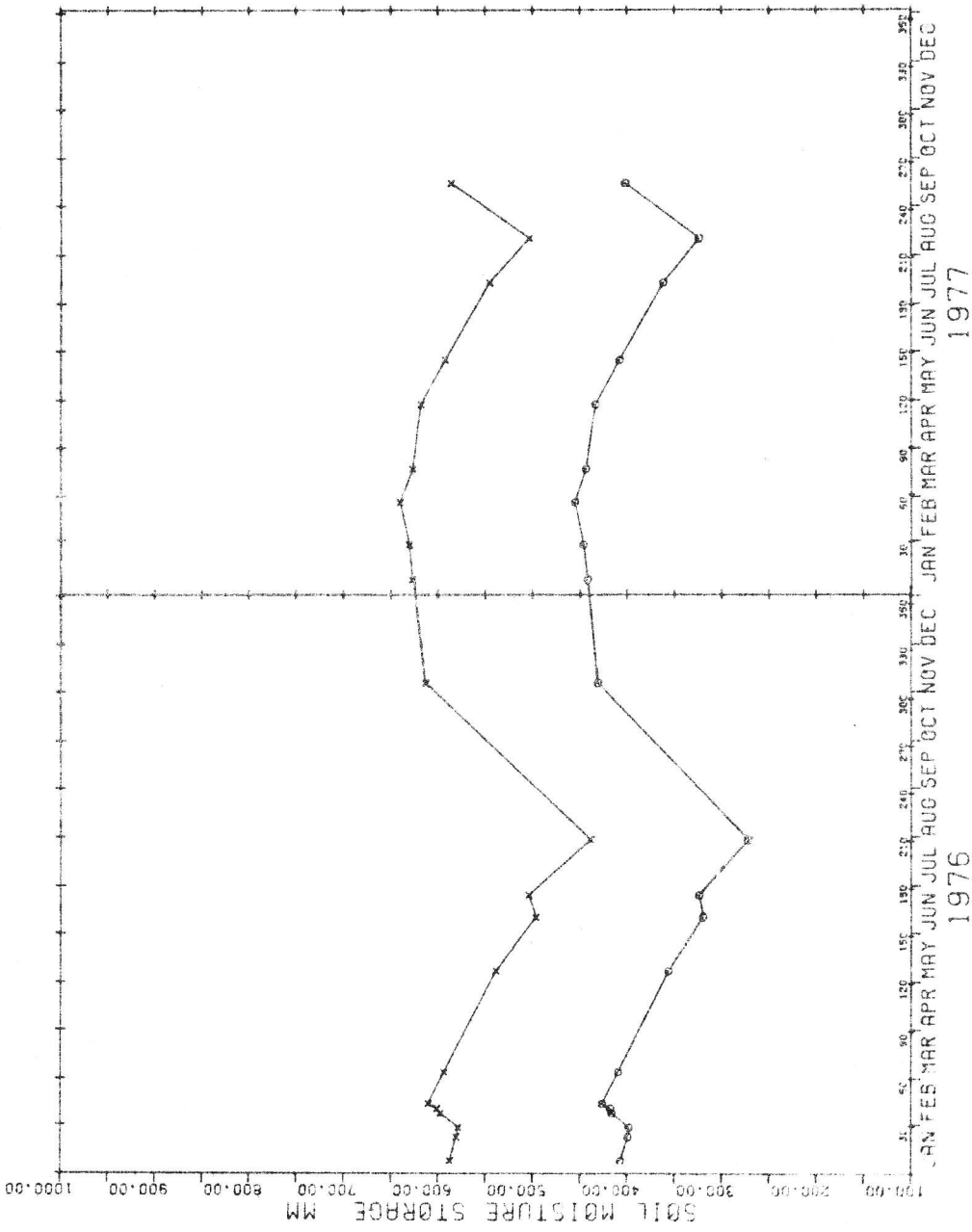


FIGURE 55 (Contd.)

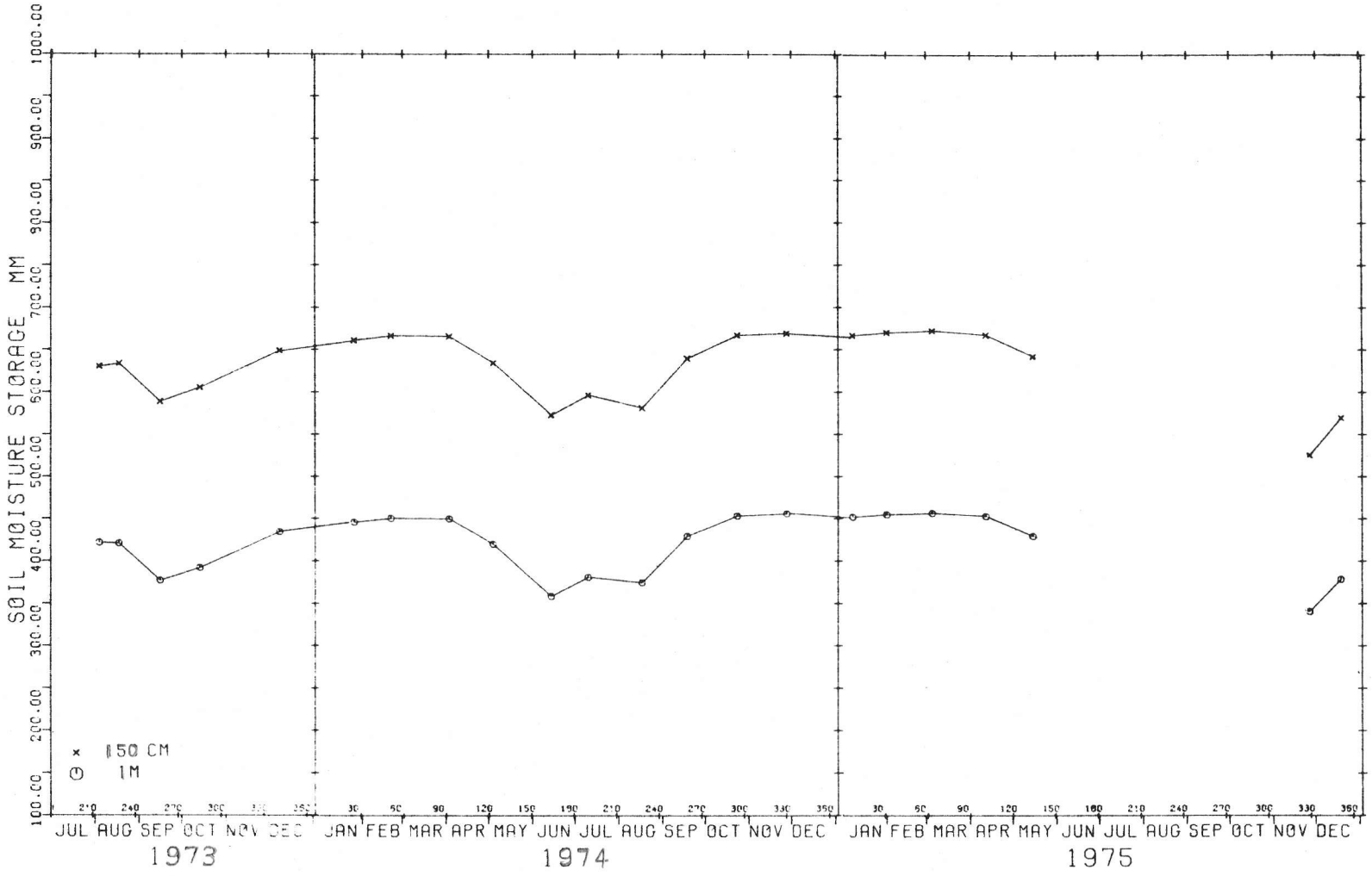


FIGURE 56

Site: M3 **PM Texture:** CLAY DRIFT **Soil:** GLEYED BROWN EARTH (PODIMORE) **Landuse:** PERMANENT PASTURE

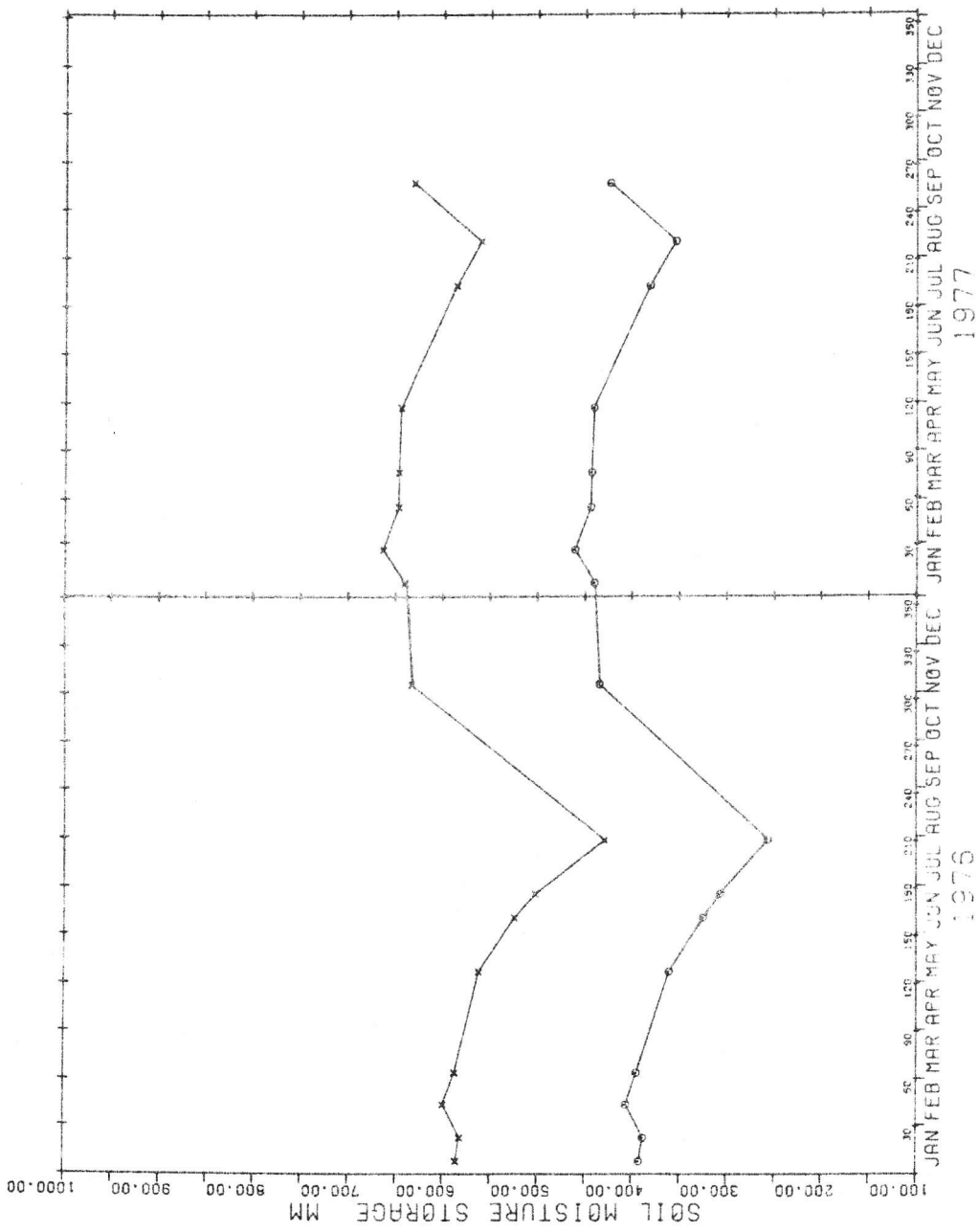


FIGURE 56 (Contd.)

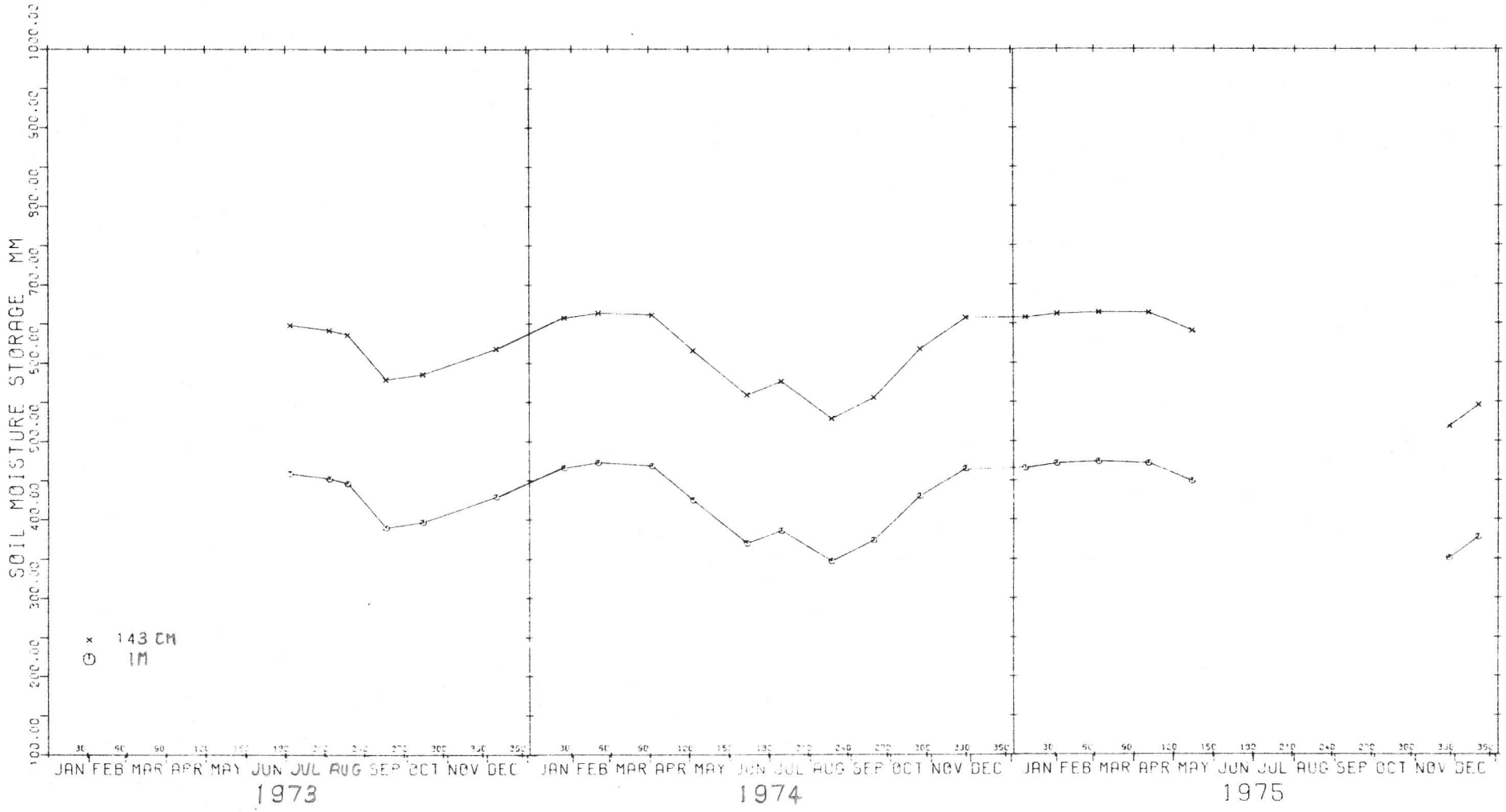


FIGURE 57

Site: M4 **PM Texture:** CLAY DRIFT **Soil:** GLEYED BROWN EARTH (PODIMORE) **Landuse:** PERMANENT PASTURE

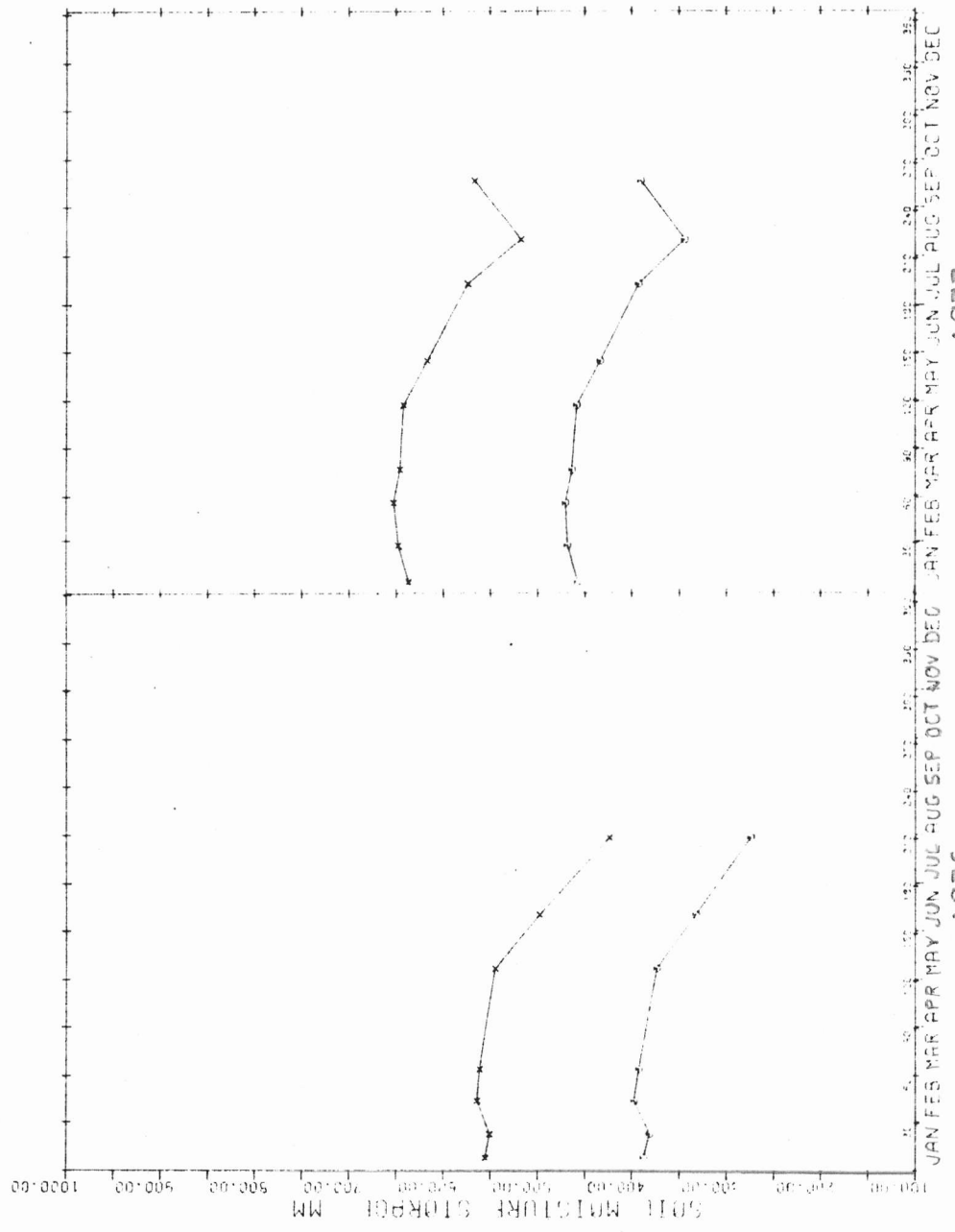


FIGURE 57 (Contd.)

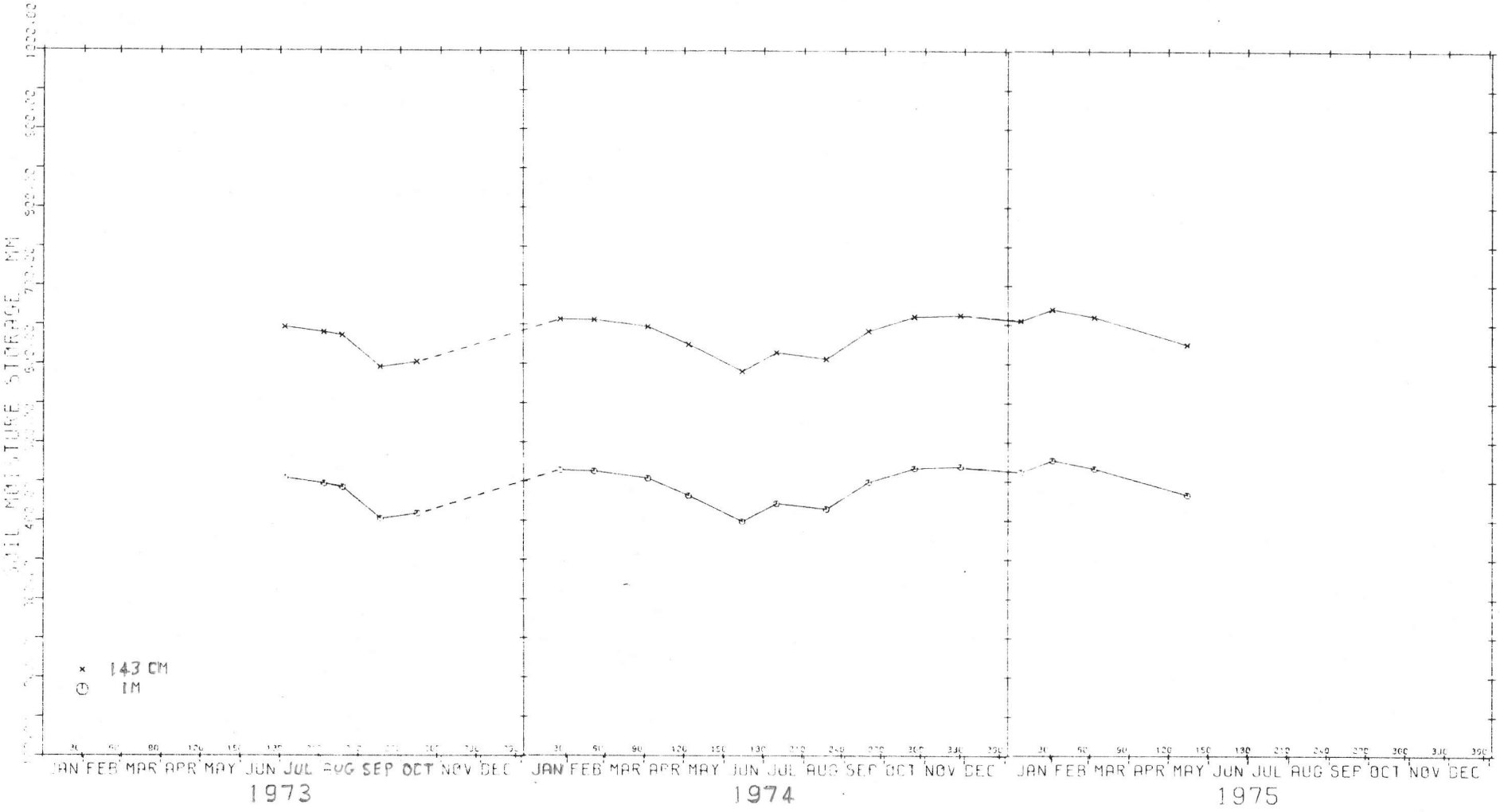


FIGURE 58

Site: M6 **PM Texture:** CLAYEY ALLUVIUM **Soil:** GLEYED BROWN EARTH (BUTLEIGH) **Landuse:** MOWN GRASS

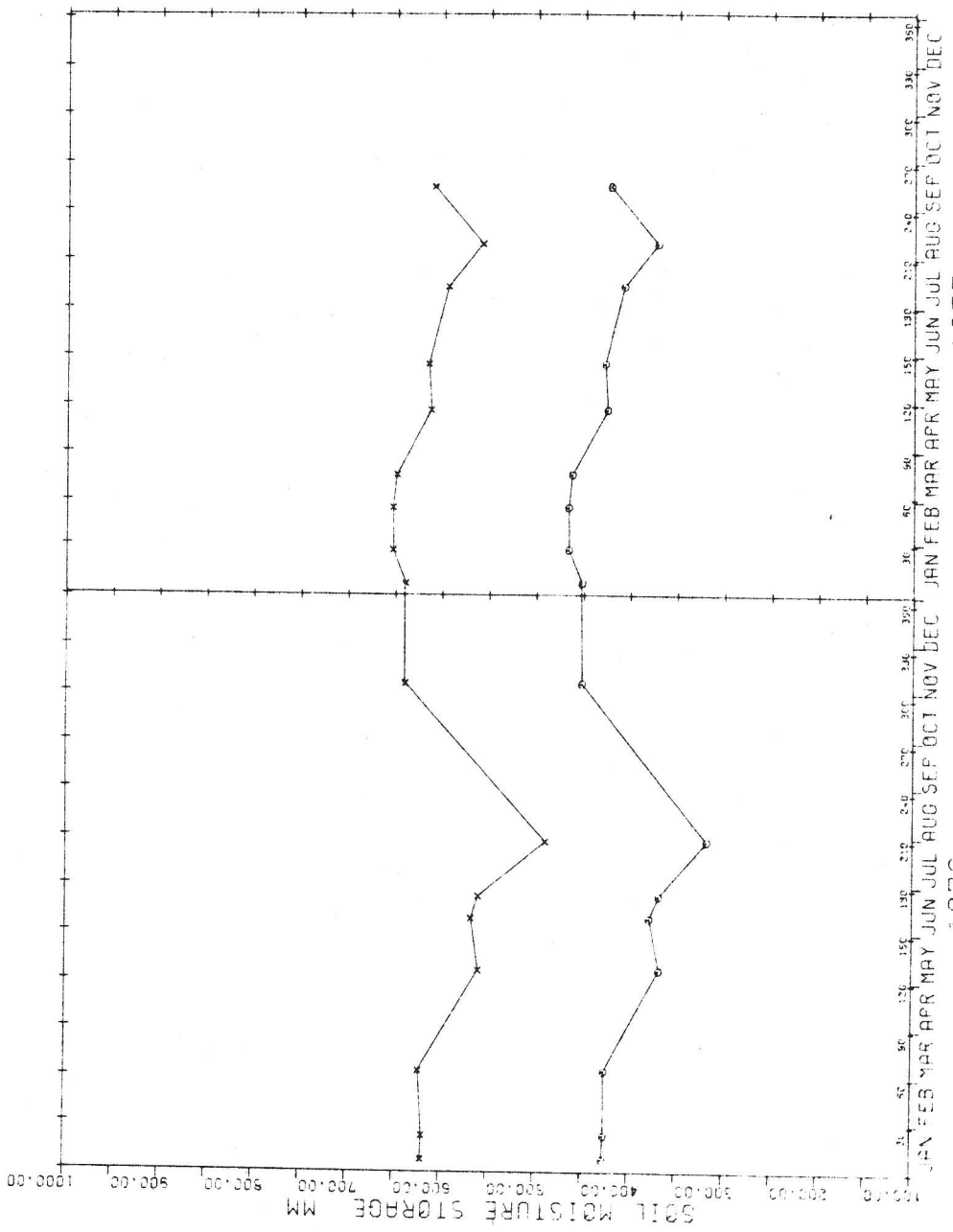


FIGURE 58 (Contd.)

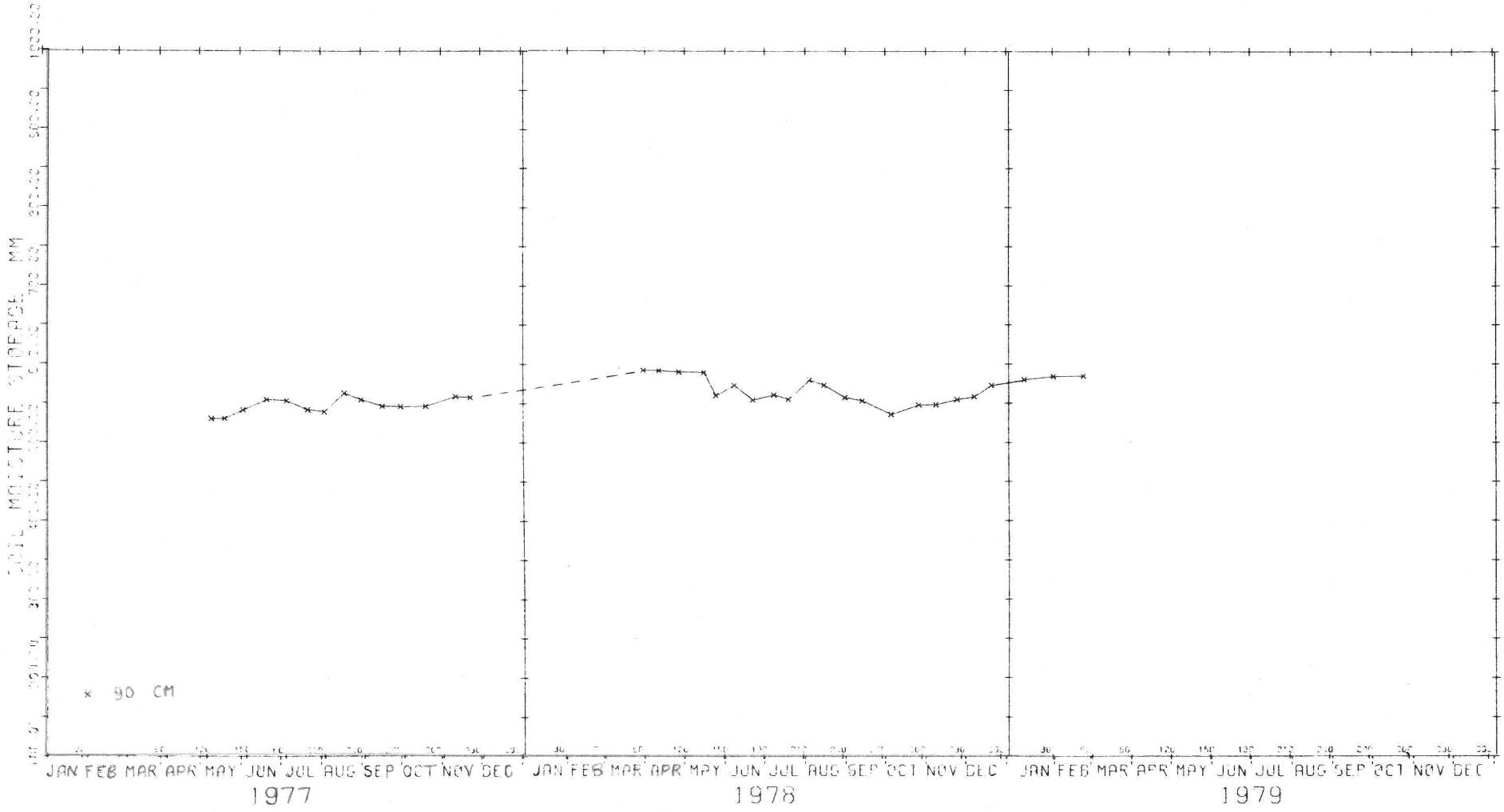


FIGURE 59

Site: N6 **PM Texture:** CLAYEY ALLUVIUM **Soil:** GROUND-WATER GLAY (COMPTON) **Landuse:** PERMANENT PASTURE

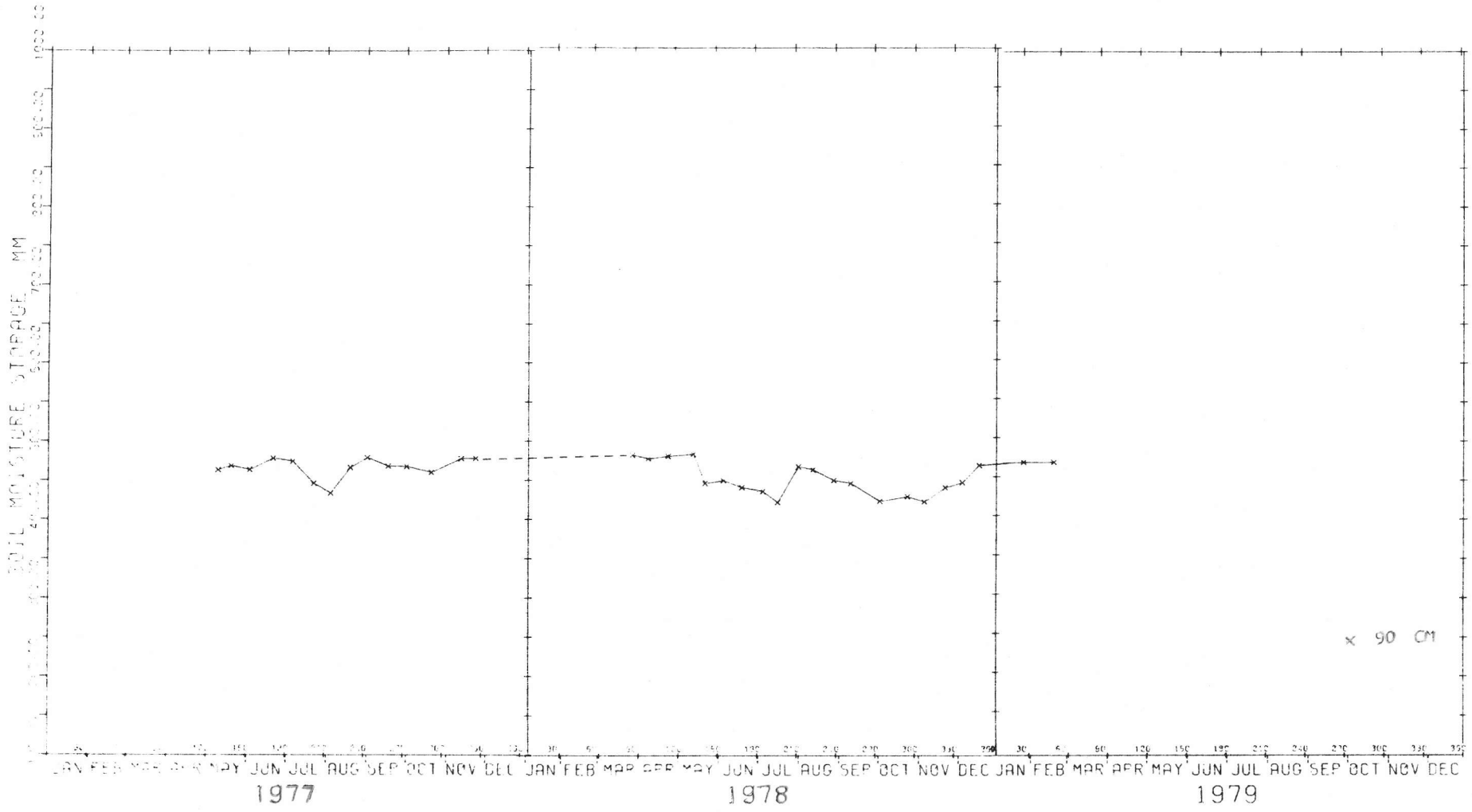


FIGURE 60

Site: N7 PM Texture: CLAYEY ALLUVIUM Soil: GROUNDWATER GLEY (COMPTON) Landuse: PERMANENT PASTURE

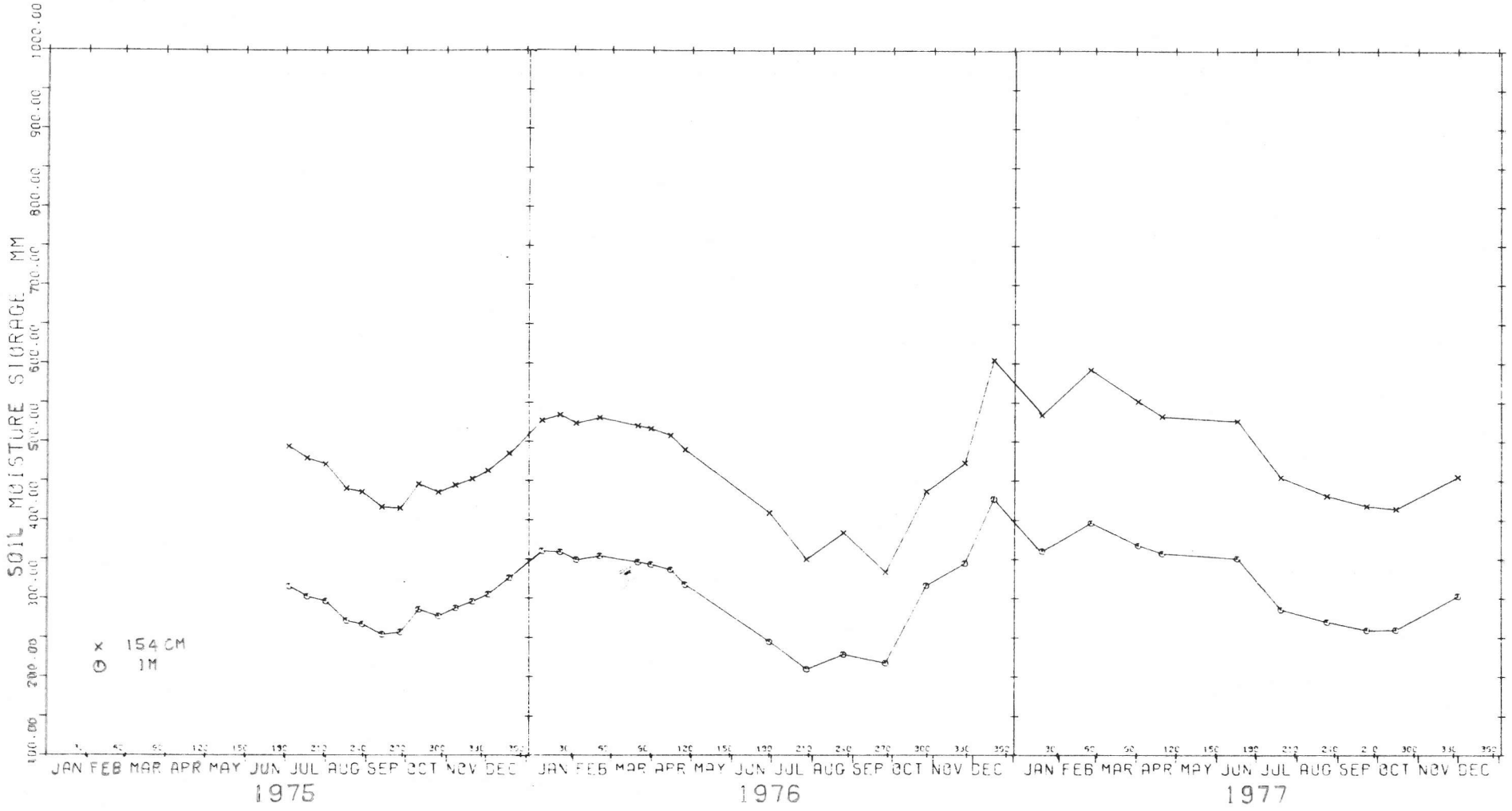


FIGURE 61

Site: F3 **PM Texture:** SANDY ALLUVIUM **Soil:** GROUNDWATER GLEY (OLLERTON COMPLEX) **Landuse:** PERMANENT PASTURE

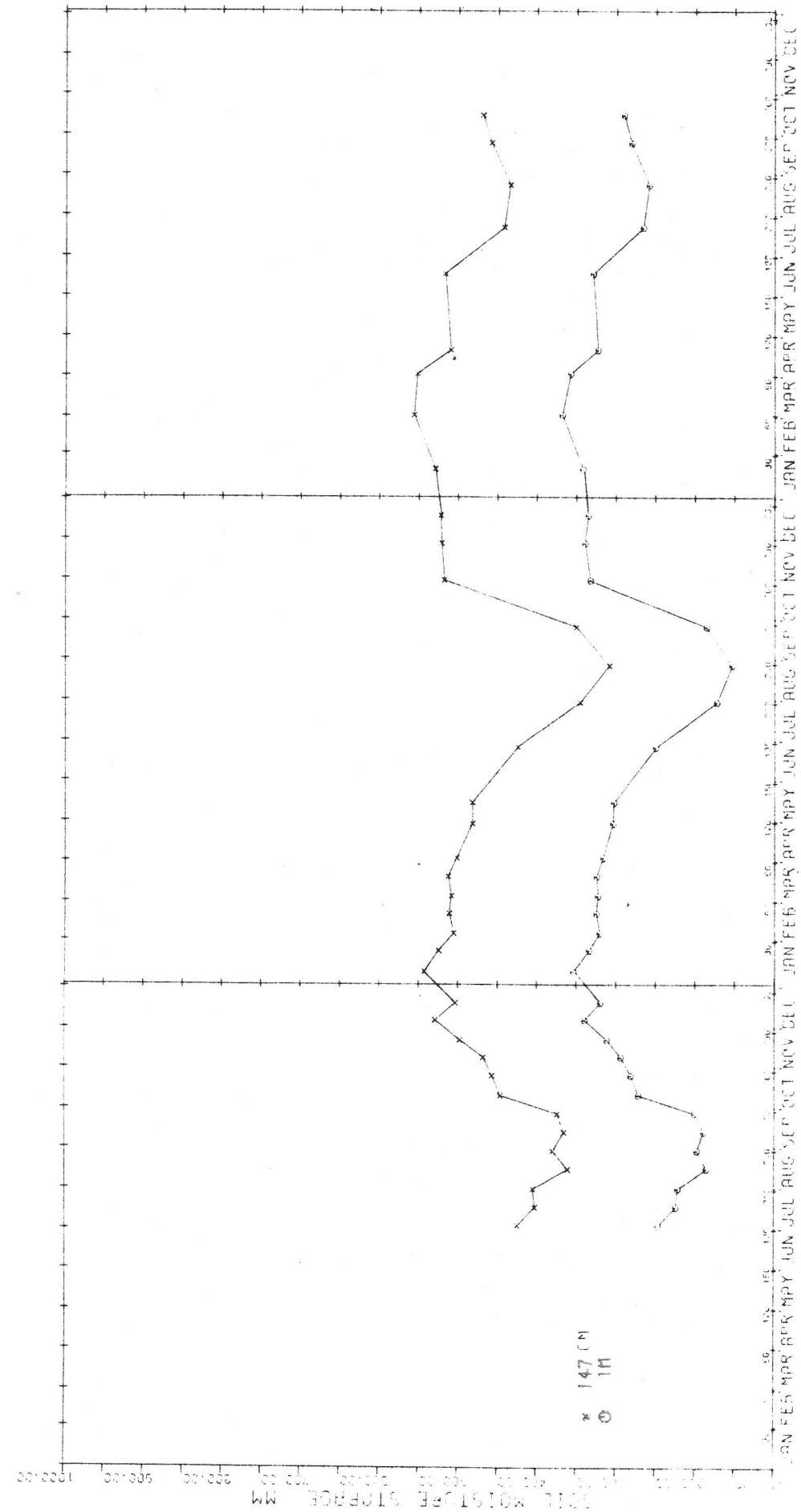


FIGURE 62

Site: F4 PM Texture: SANDY ALLUVIUM Soil: GROUNDWATER GLEY (OLLERTON COMPLEX) Landuse: UNKEMPT GRASS

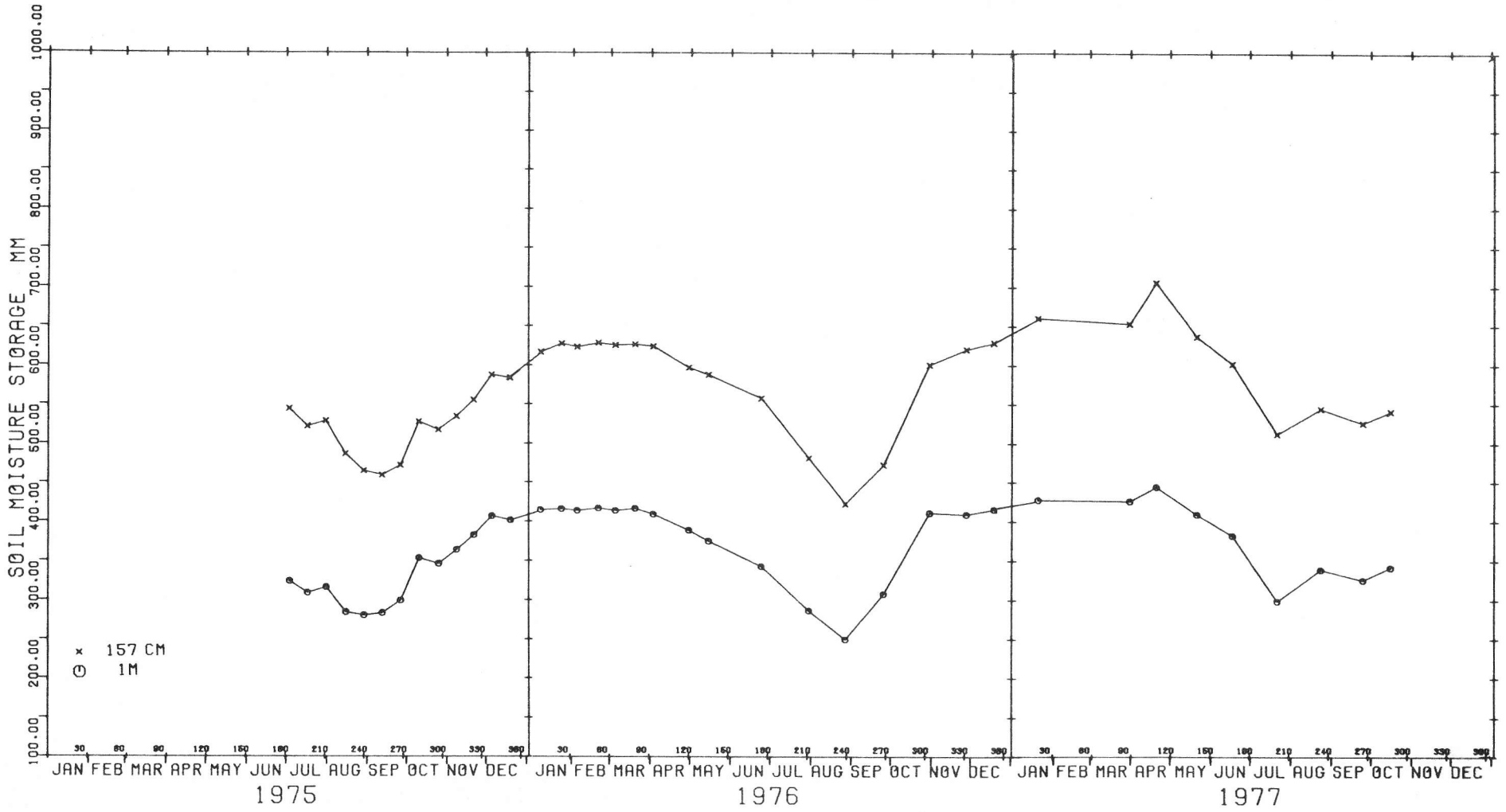


FIGURE 63

Site: F7 PM Texture: SANDY ALLUVIUM Soil: GROUNDWATER GLEY (OLLERTON COMPLEX) Landuse: UNKEMPT GRASS

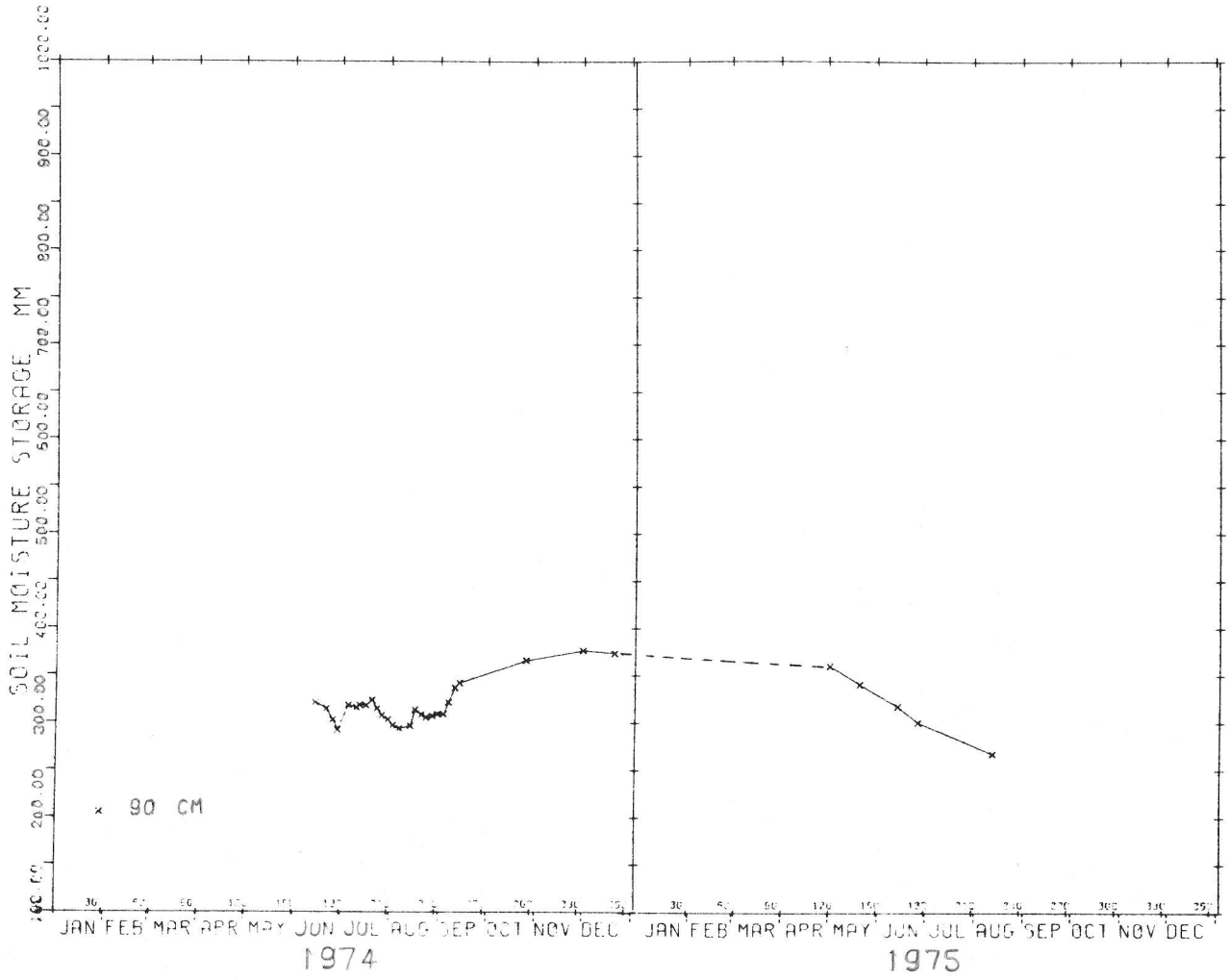


FIGURE 64

Site: A2 **PM Texture:** CLAYEY DRIFT **Soil:** SURFACE WATER GLEY (PITMEDDEN) **Landuse:** SPRING BARLEY

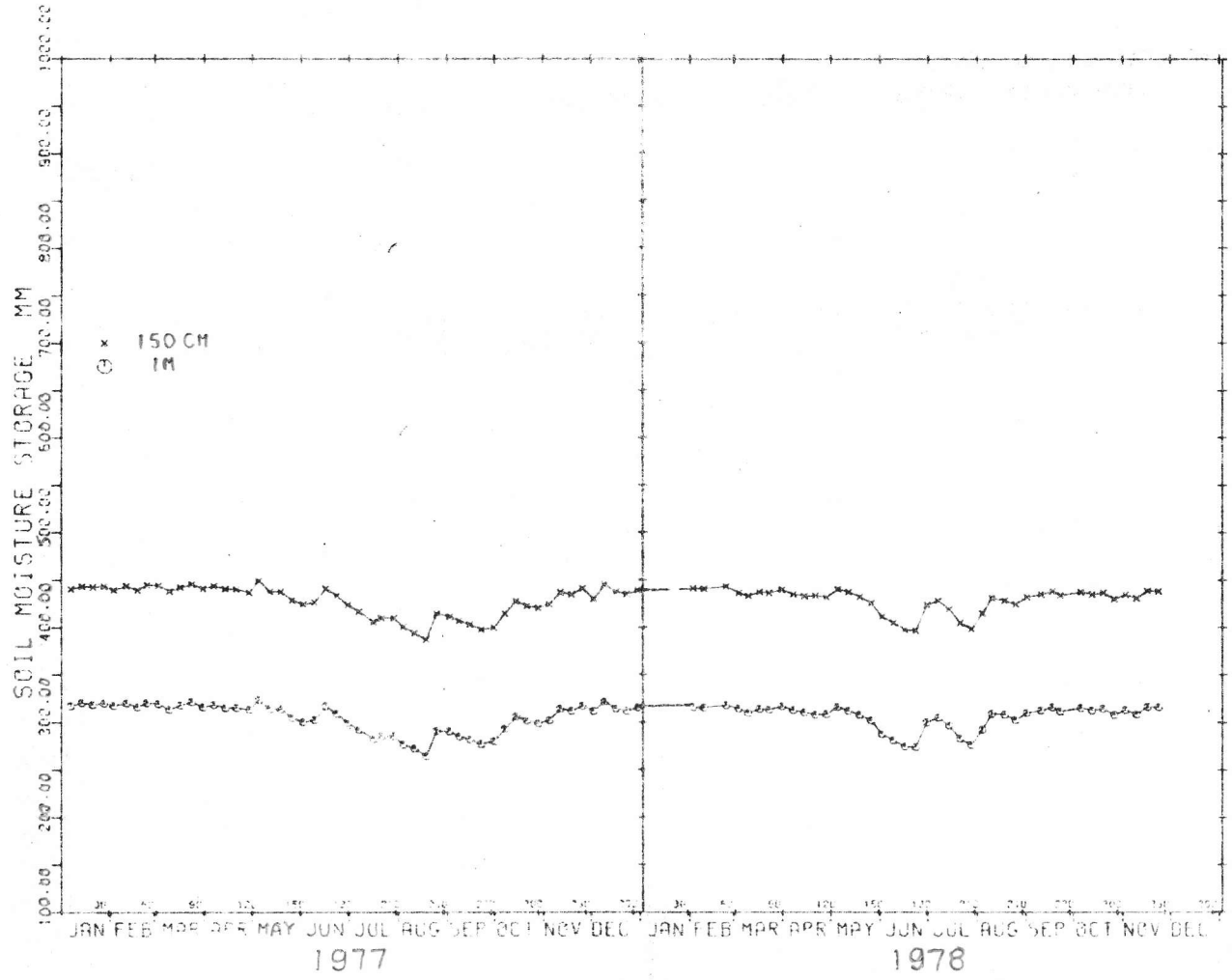


FIGURE 65

Site: C2 **PM Texture:** CLAYEY DRIFT **Soil:** SURFACE WATER GLEY (BELMONT-WILCOX COMPLEX) **Landuse:** ROUGH GRAZING (Heather moor)

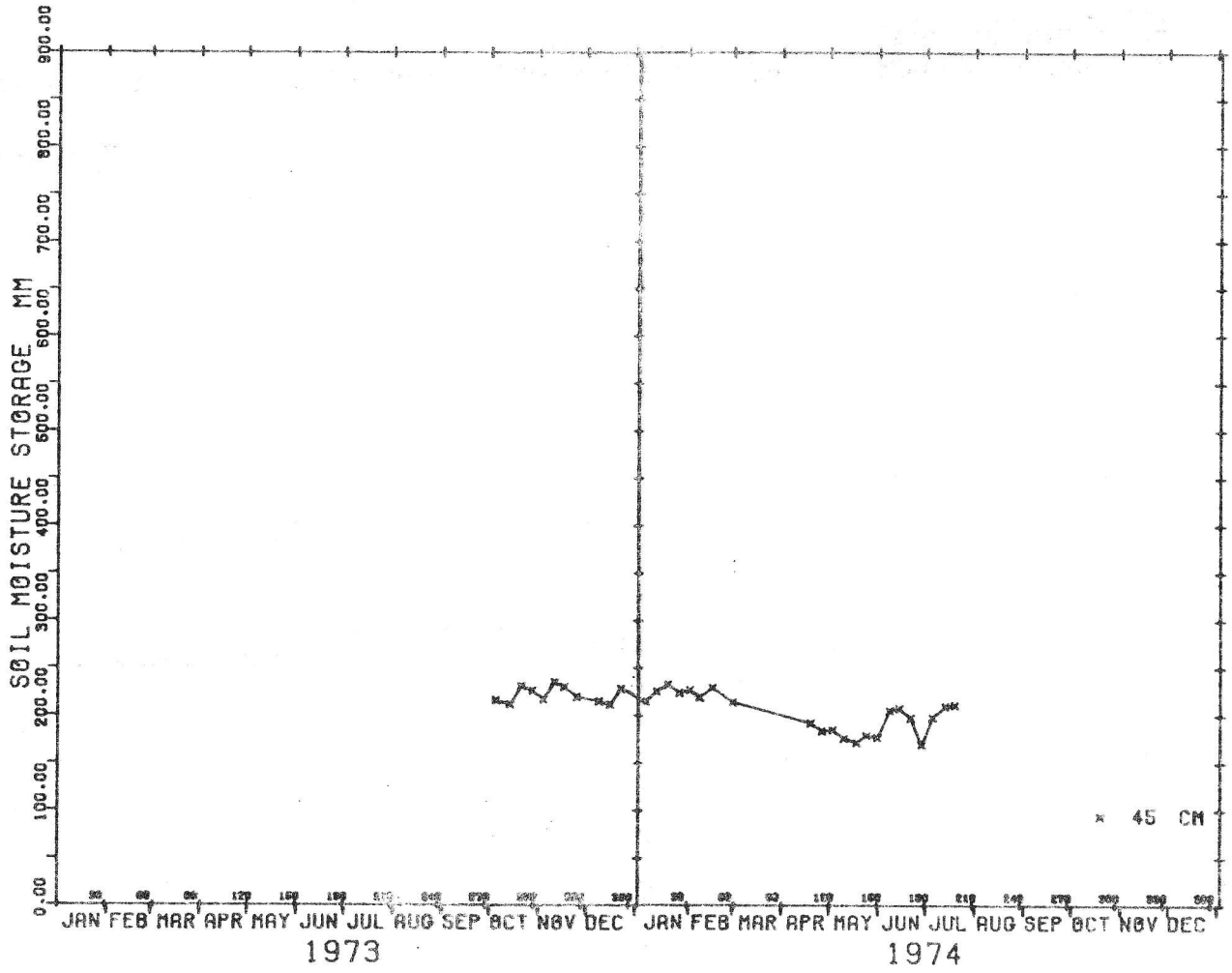


FIGURE 66

Site: D2 PM Texture: SANDY CLAY Soil: SURFACE WATER GLEY (BRANTWOOD ASSOCIATION) Landuse: ROUGH GRASS

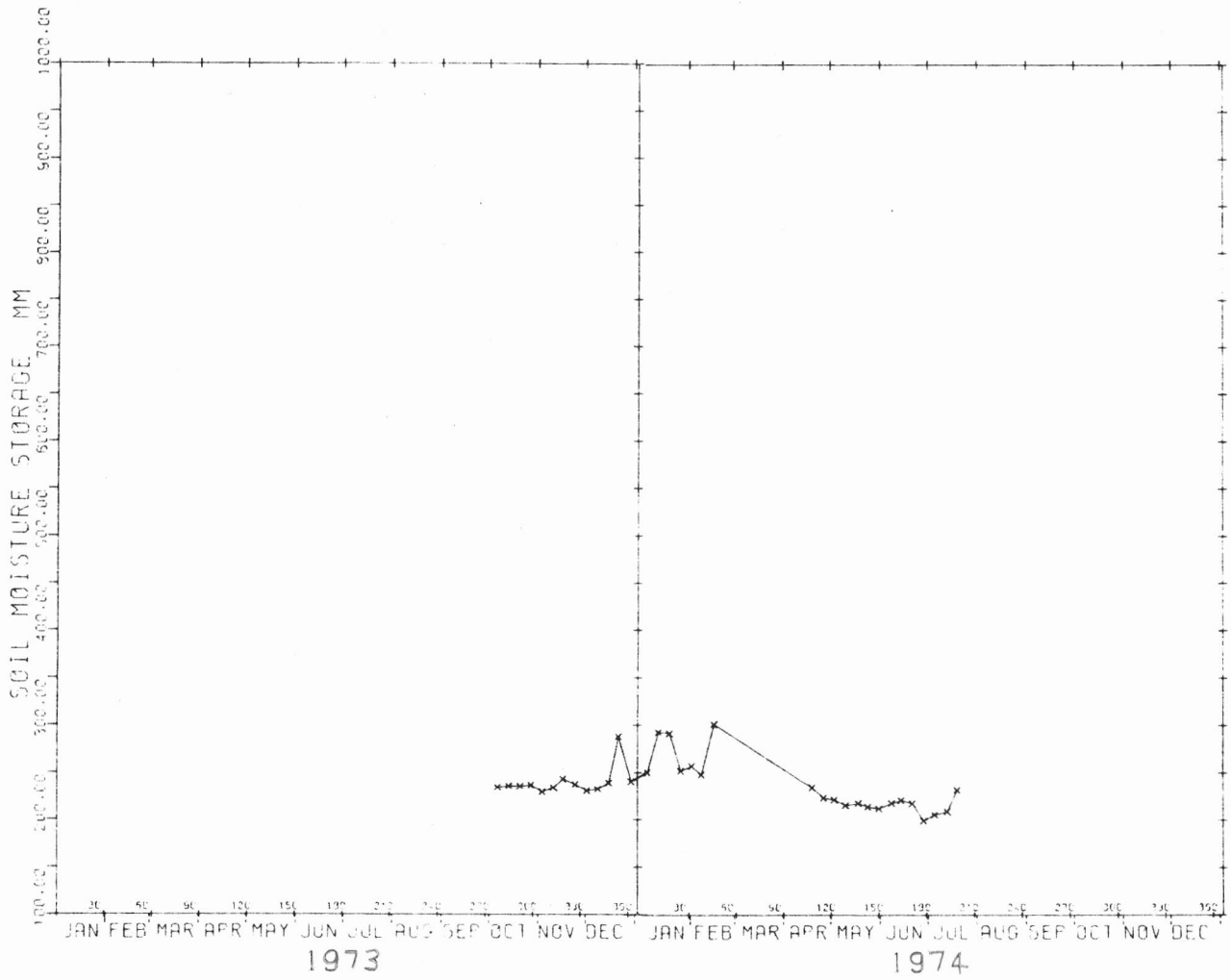


FIGURE 67

Site: D8 **PM Texture:** SANDY CLAY DRIFT **Soil:** SURFACE WATER GLEY (RIVINGTON ASSOCIATION) **Landuse:** ROUGH GRAZING Heather moor)

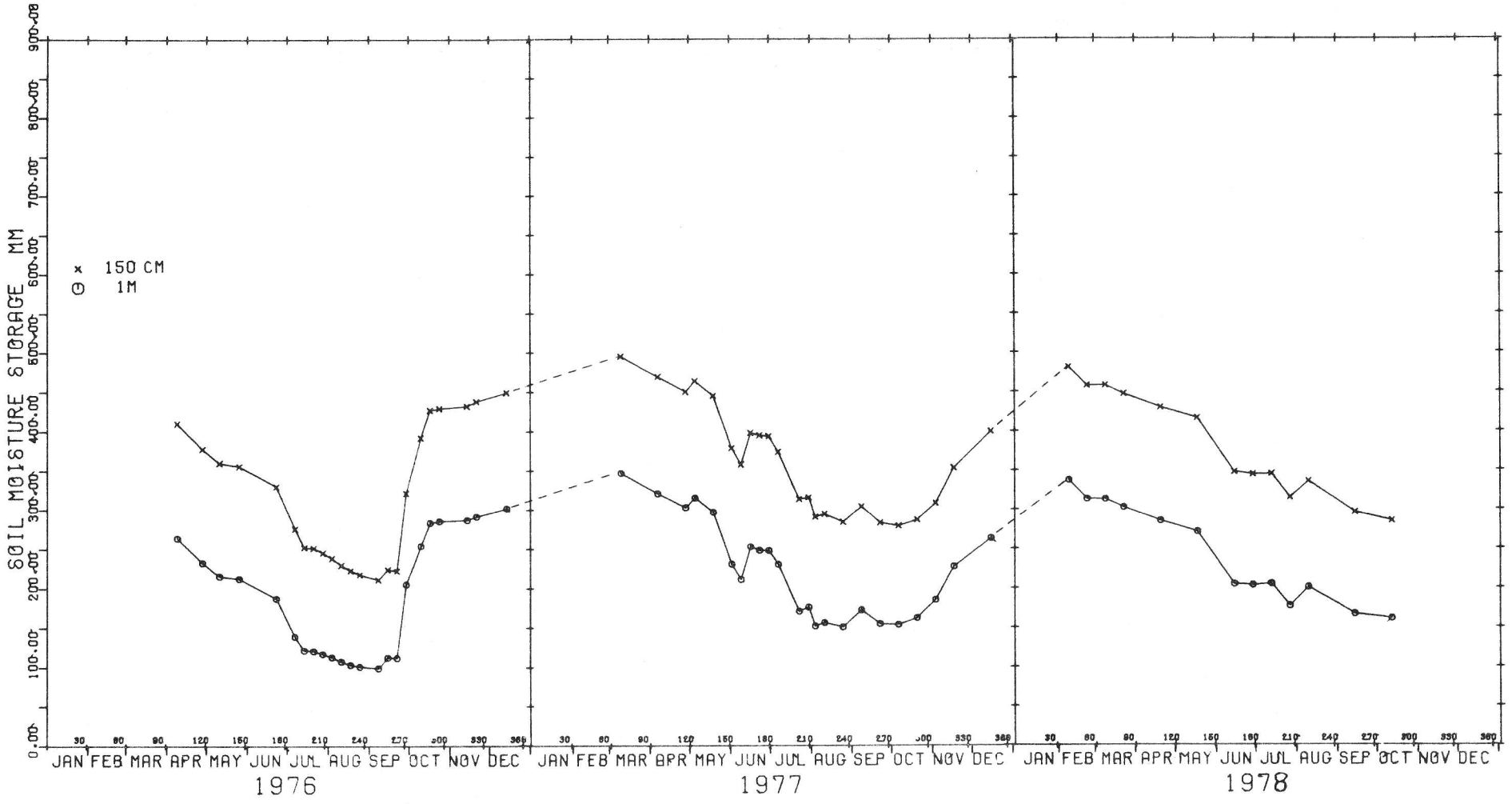


FIGURE 68

Site: G1 PM Texture: LOAMY DRIFT Soil: GLEYED BROWN EARTH (CLIFTON) Landuse: MOWN GRASS

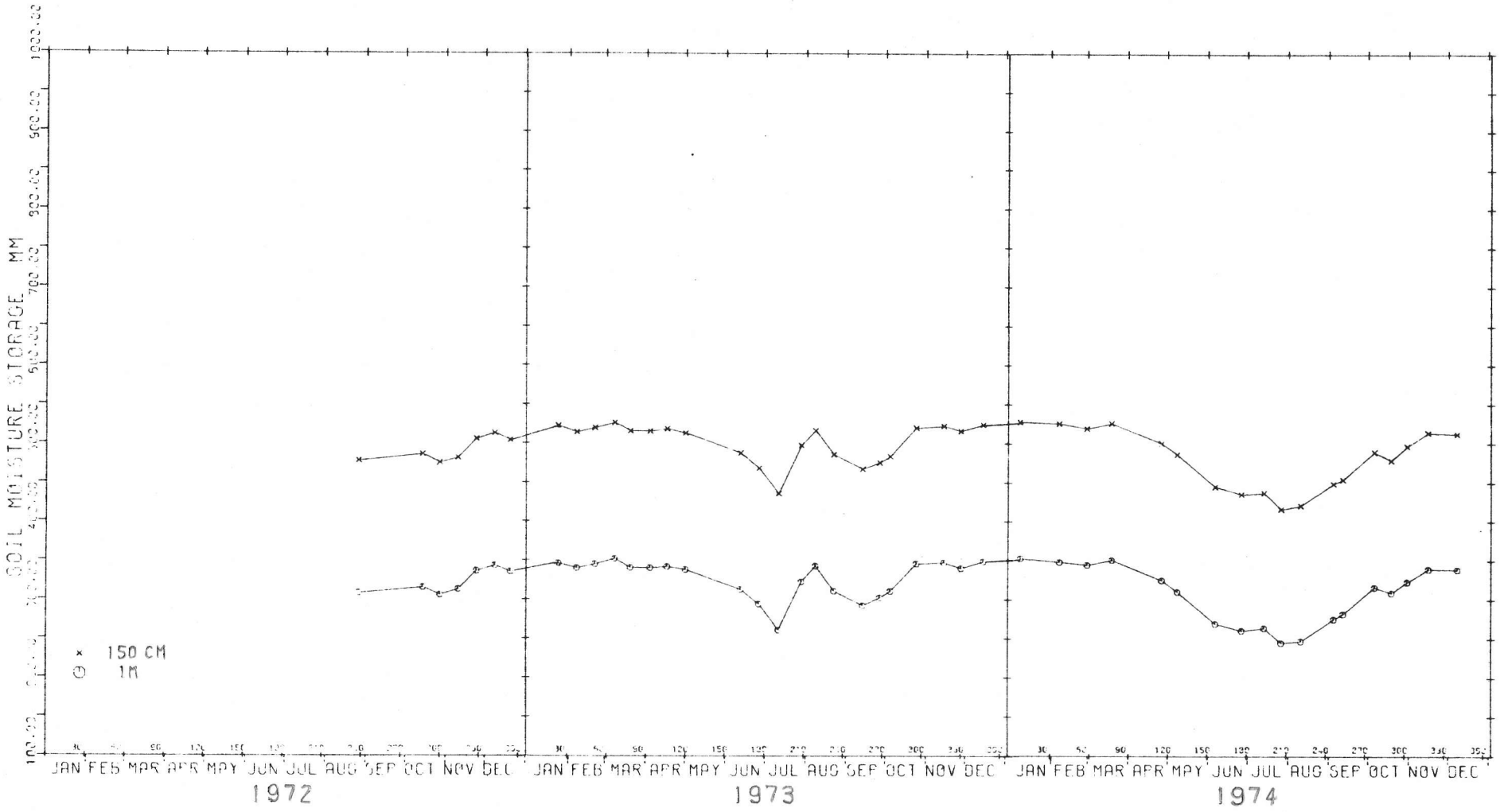


FIGURE 69

Site: H1 **PM Texture:** LOAMY DRIFT **Soil:** SURFACE WATER GLEY (CLIFTON) **Landuse:** MOWN GRASS

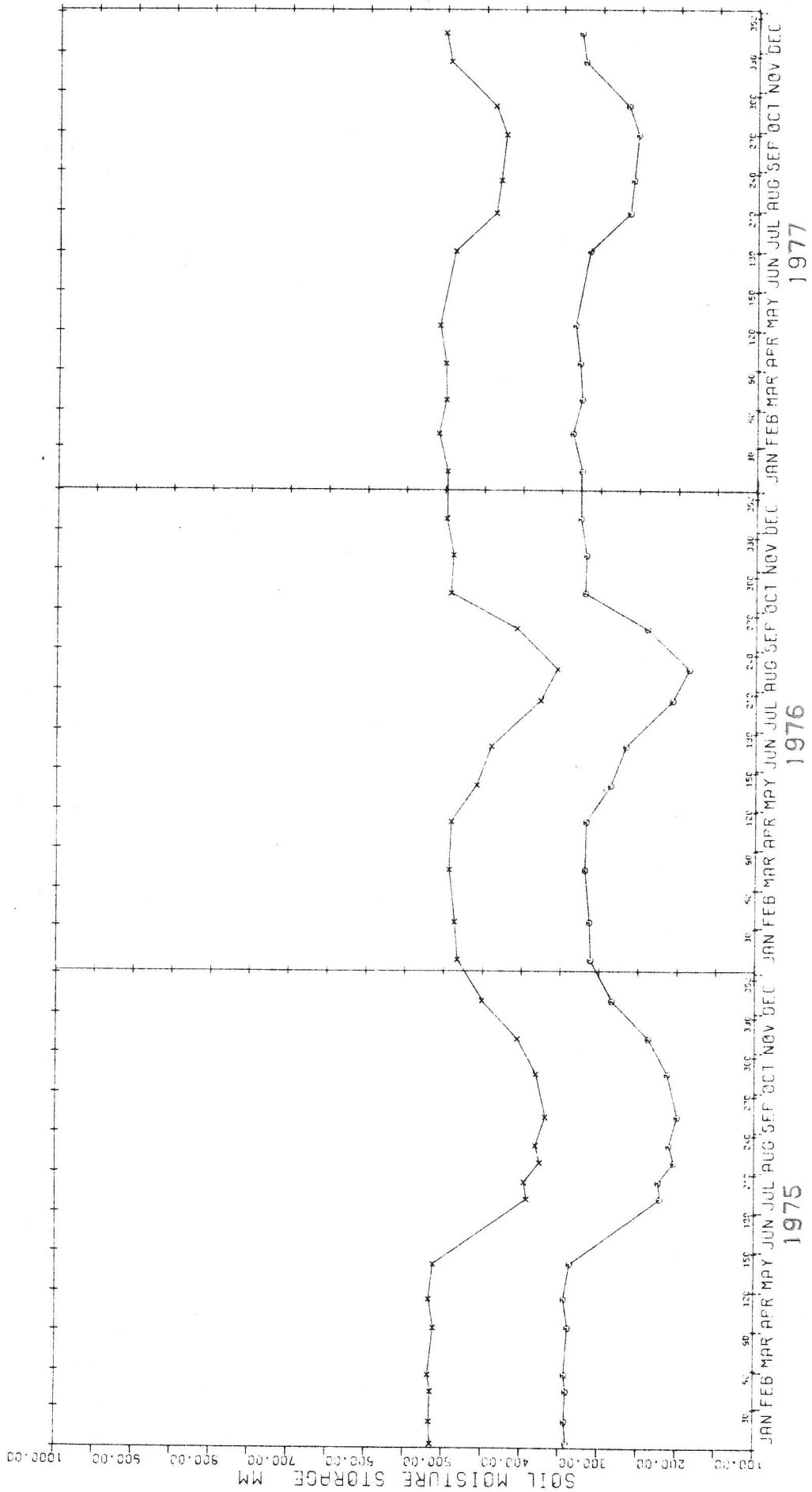


FIGURE 69 (Contd.)

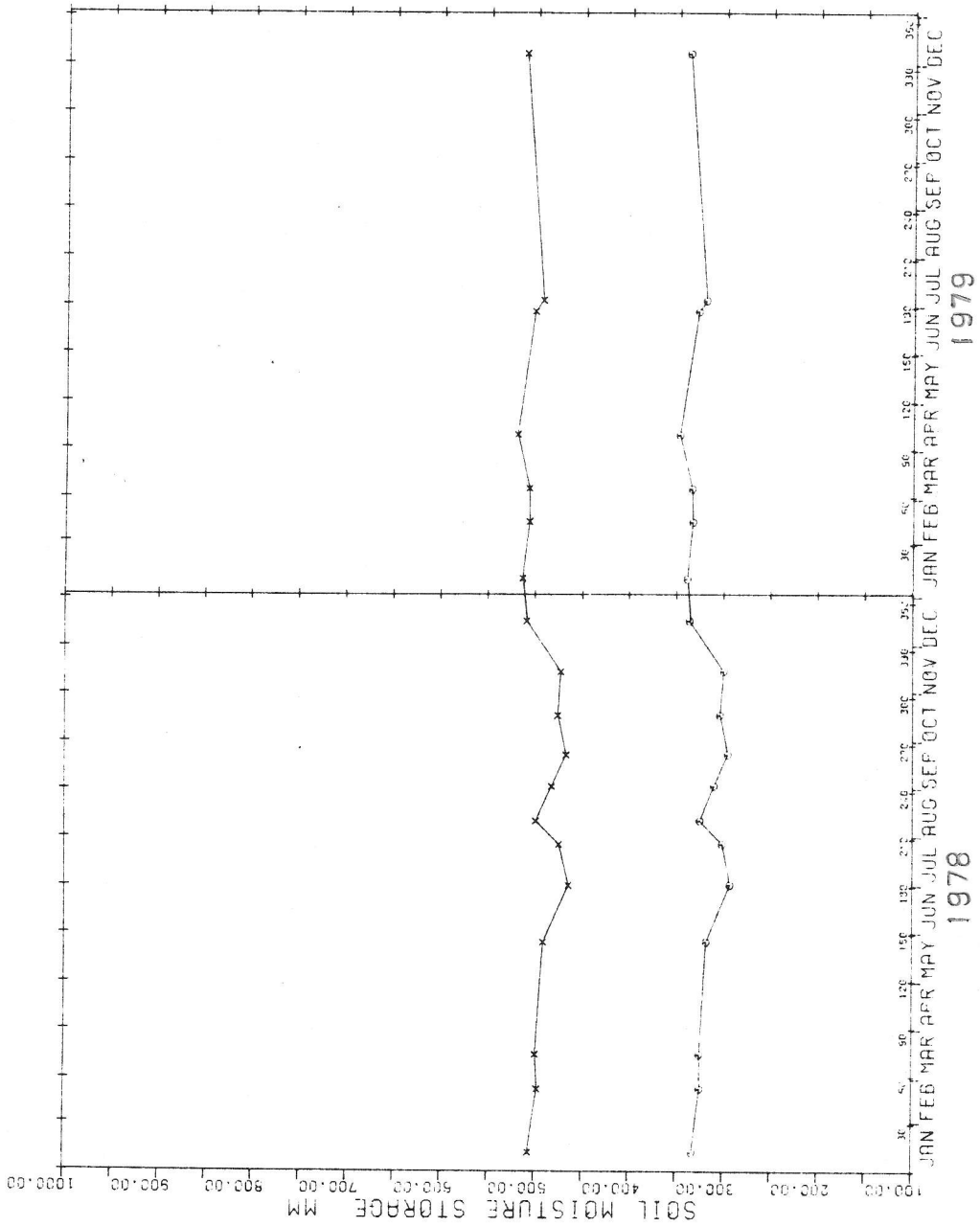


FIGURE 69 (Contd.)

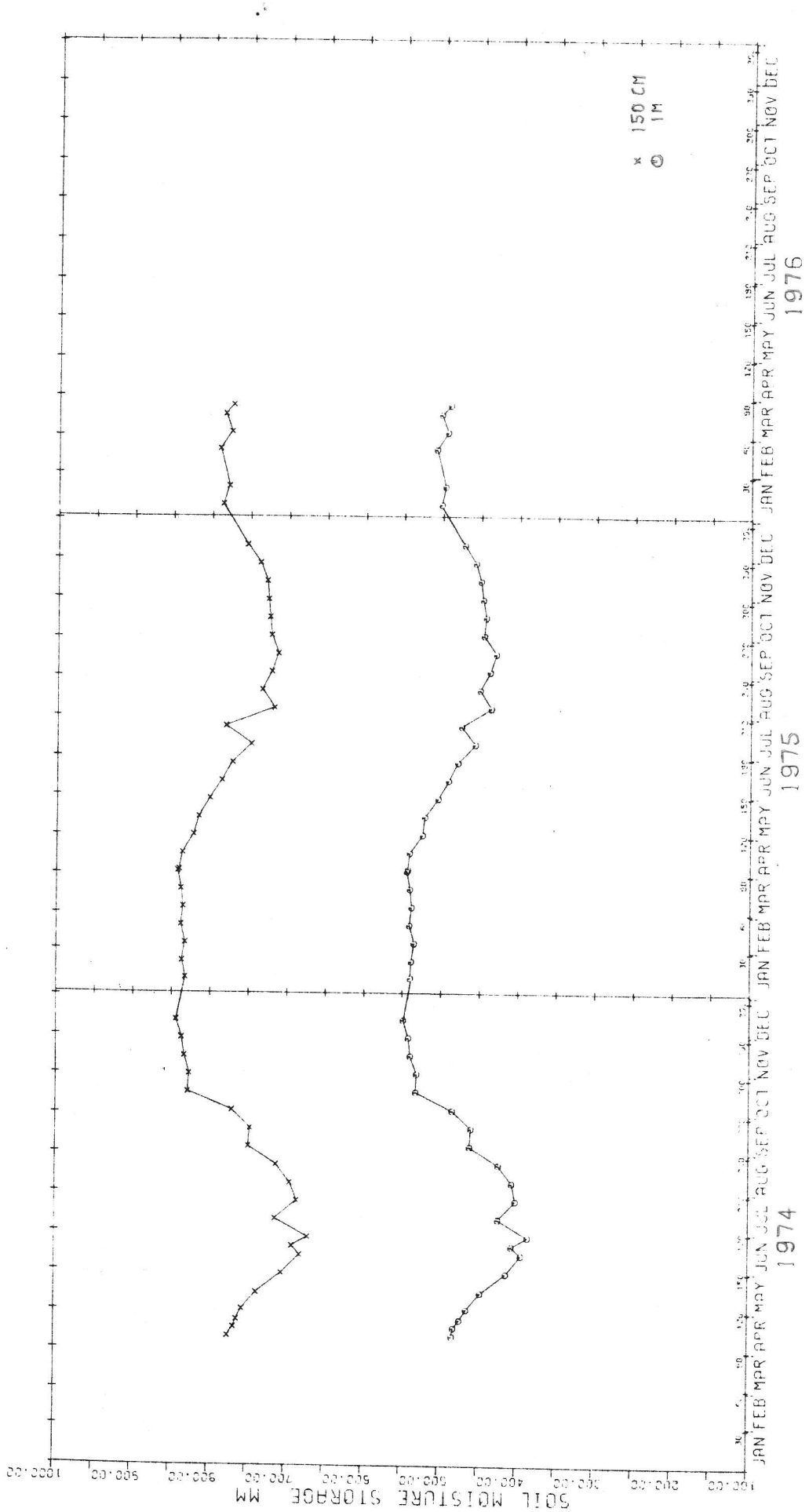


FIGURE 70

Site: E1 **PM Texture:** CLAYEY ALLUVIUM **Soil:** GROUNDWATER GLEY **Landuse:** ARABLE (DOWNHOLLAND)

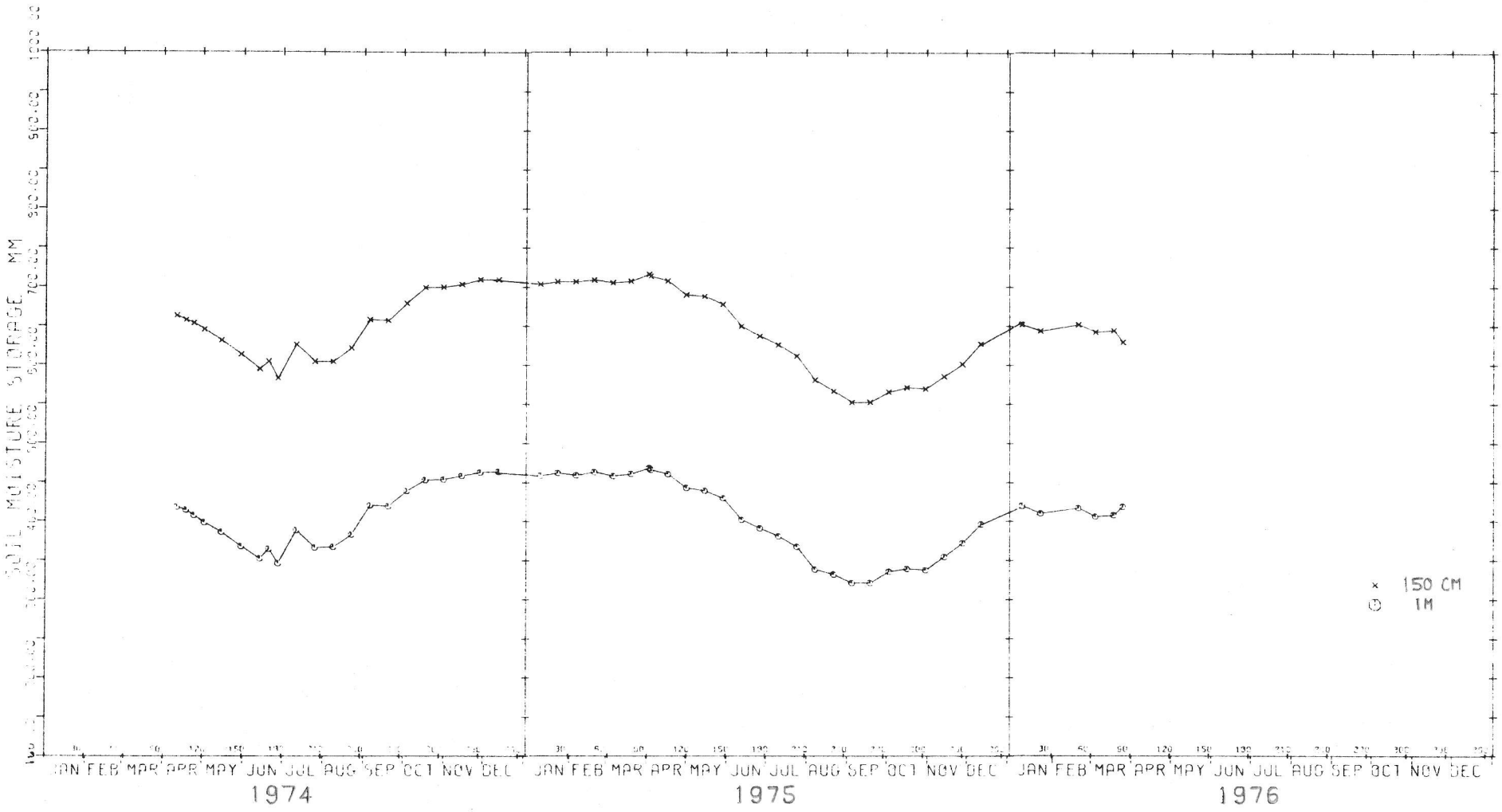


FIGURE 71

Site: E2 **PM Texture:** LOAMY ALLUVIUM **Soil:** GROUND WATER GLEY (ROMNEY) **Landuse:** ARABLE

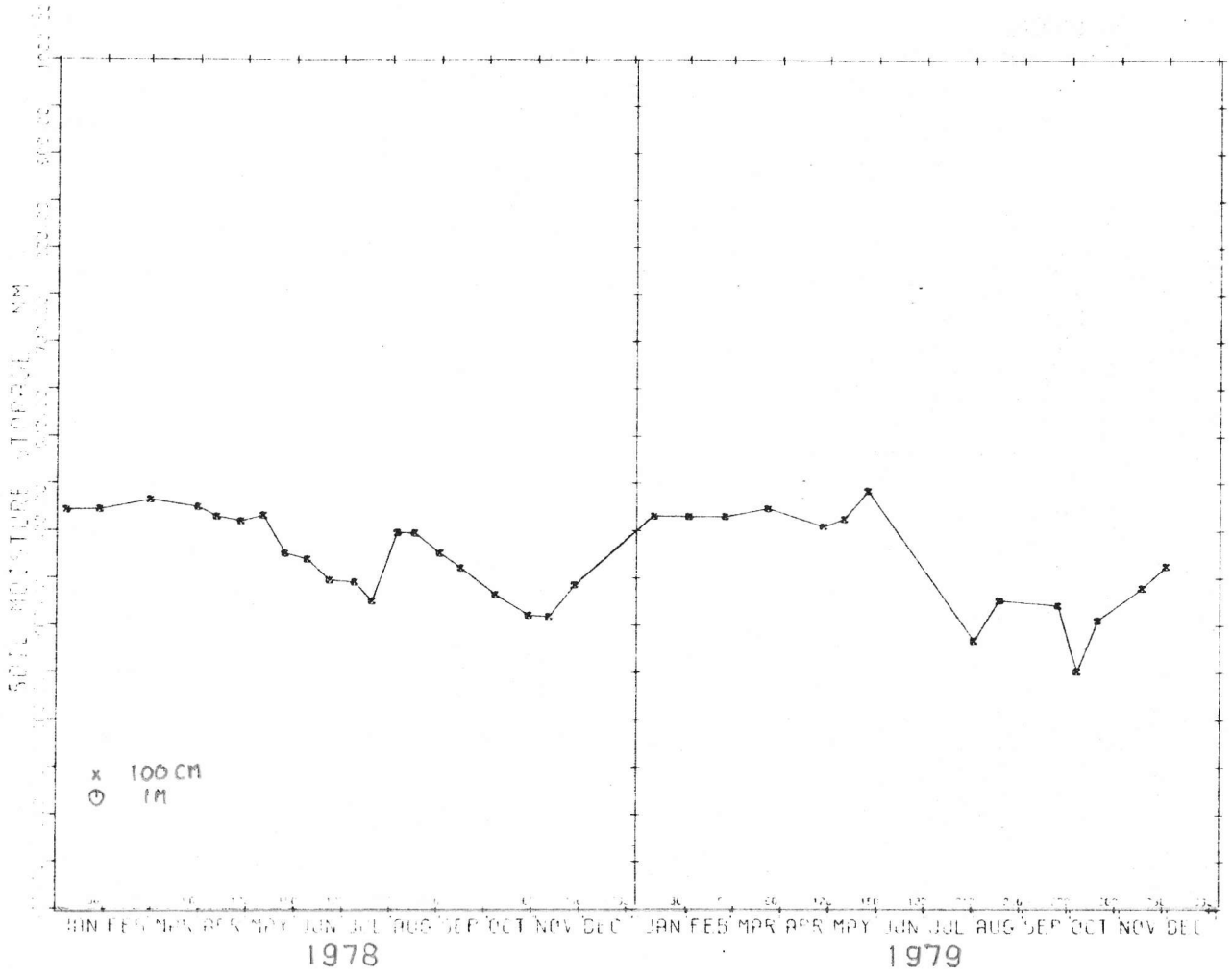


FIGURE 72

Site: N10 **PM Texture:** CLAY **Soil:** SURFACE WATER GLEY (SPELLER) **Landuse:** GRASS

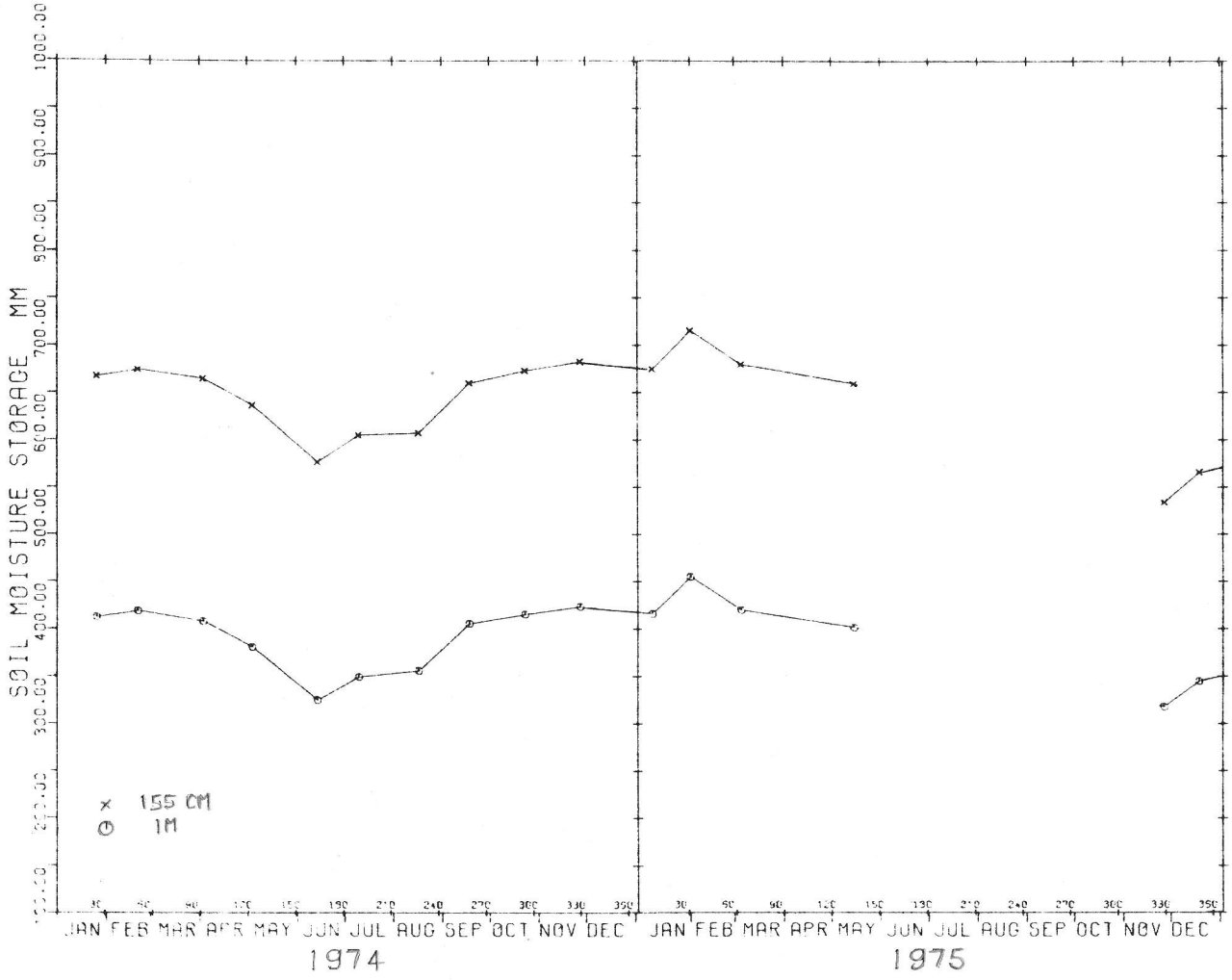


FIGURE 73a

Site: M5 **PM Texture:** LOAM **Soil:** SURFACE WATER GLEY (LONGLOAD) **Landuse:** PERMANENT PASTURE

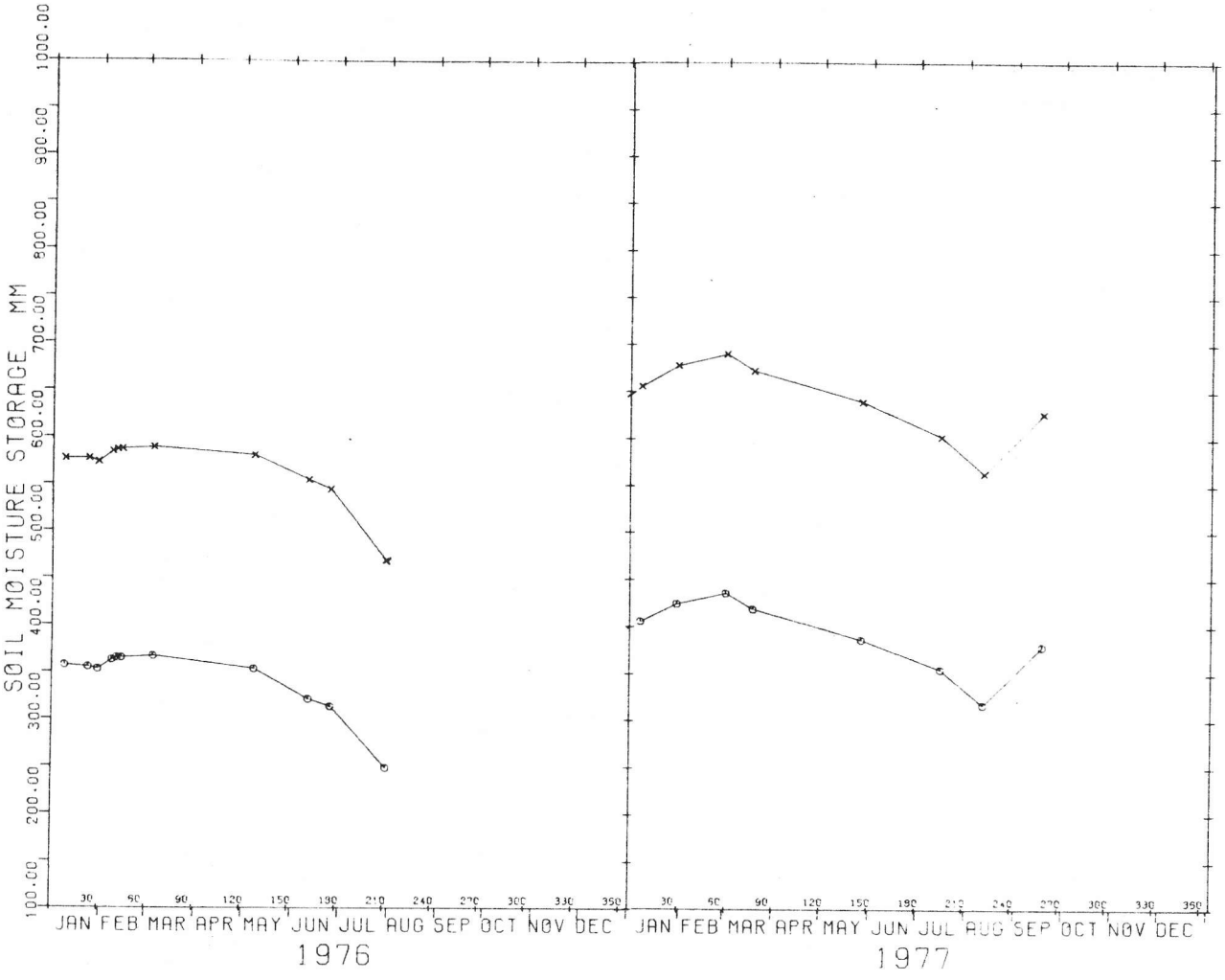


FIGURE 73a (Contd.)

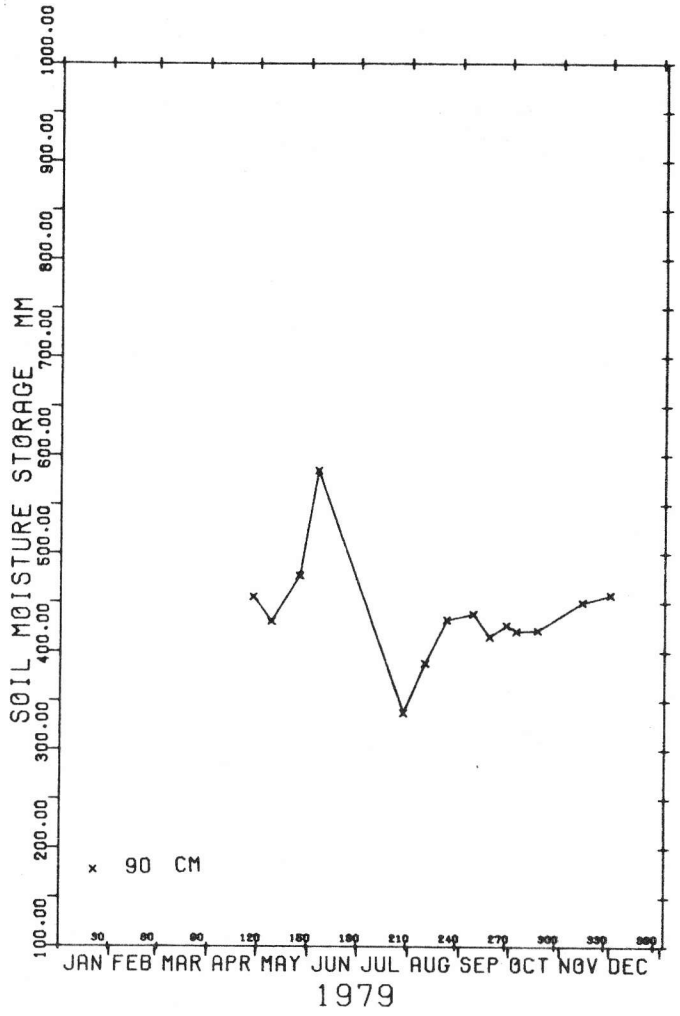


FIGURE 73b

Site: N16
PM Texture: CLAY
Soil: SURFACE WATER GLEY (LONGLOAD)
Landuse: GRASS LEY

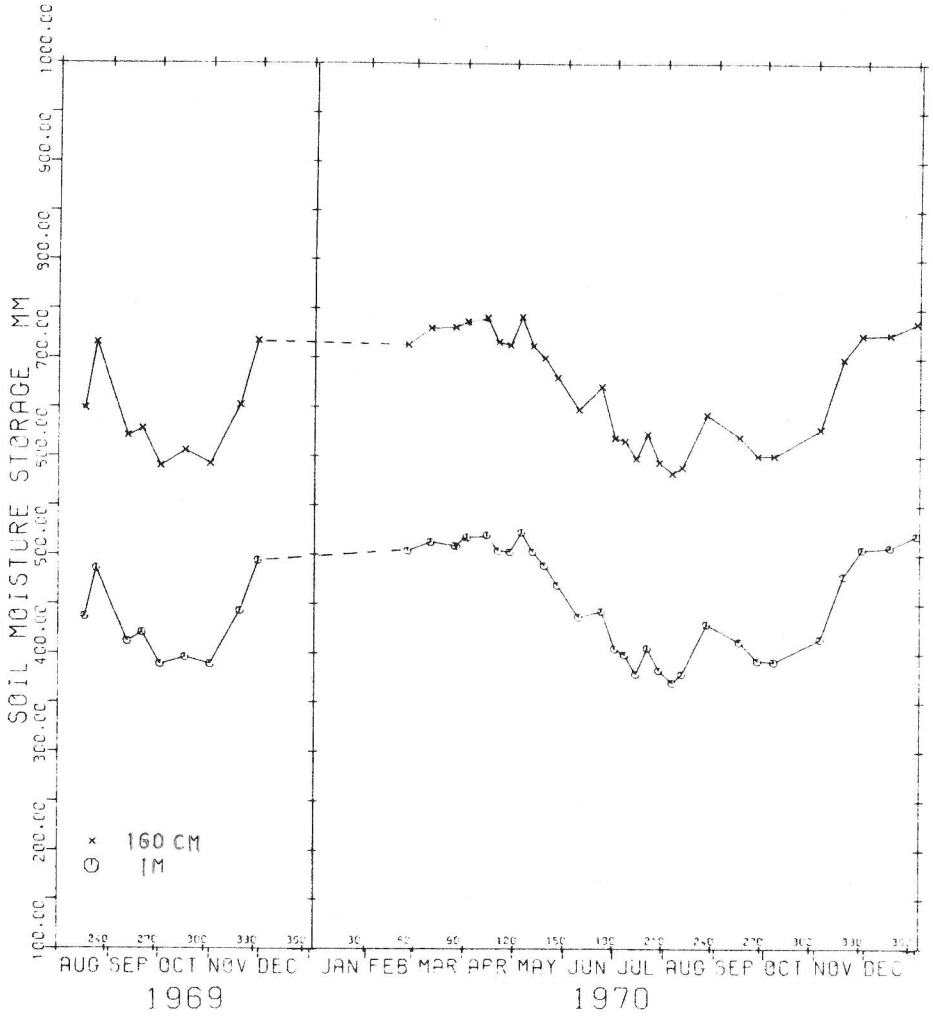


FIGURE 74a

Site: T3
PM Texture: CLAY
Soil: SURFACE WATER GLEY (DENCHWORTH)
Landuse: MOWN GRASS

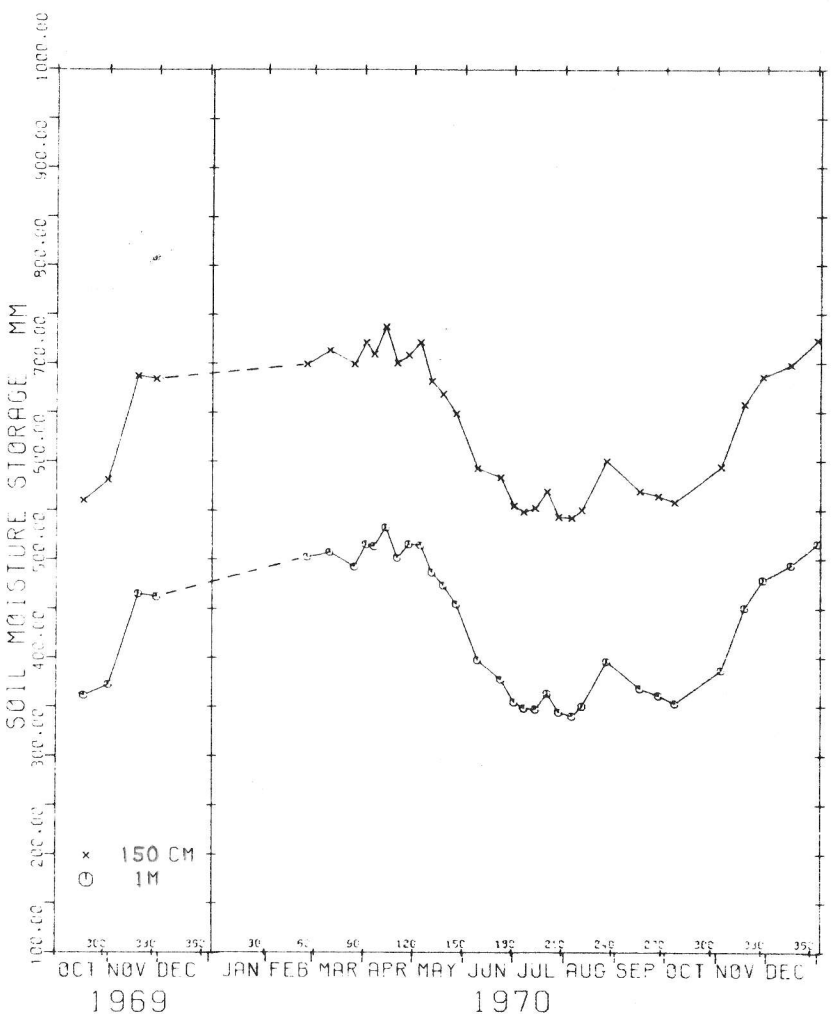


FIGURE 74b

Site: T4
PM Texture: CLAY
Soil: SURFACE WATER GLEY (DENCHWORTH)
Landuse: GRASS

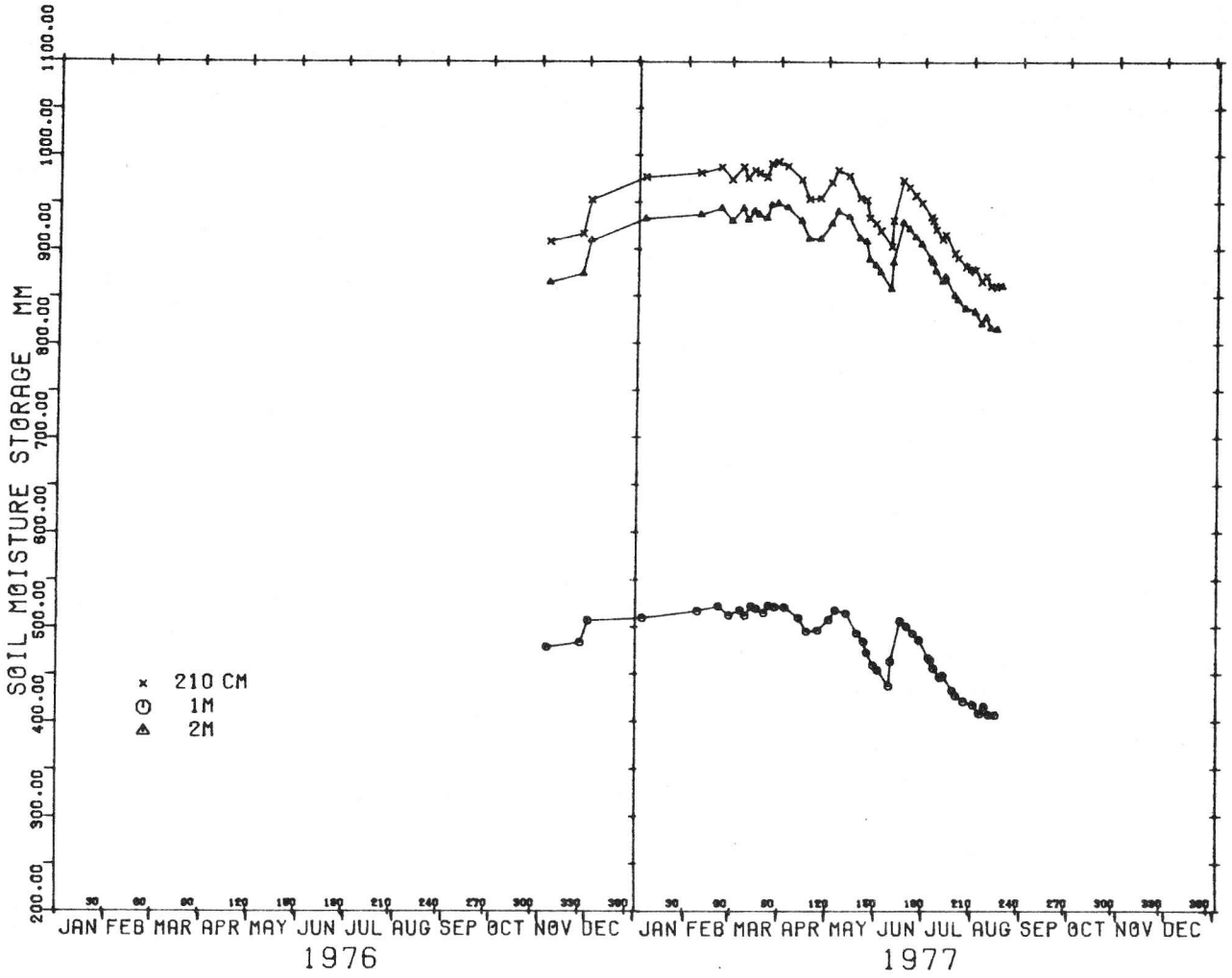


FIGURE 75

Site: R1 PM Texture: CLAY Soil: SURFACE WATER GLEY (DENCHWORTH) Landuse: WINTER OATS

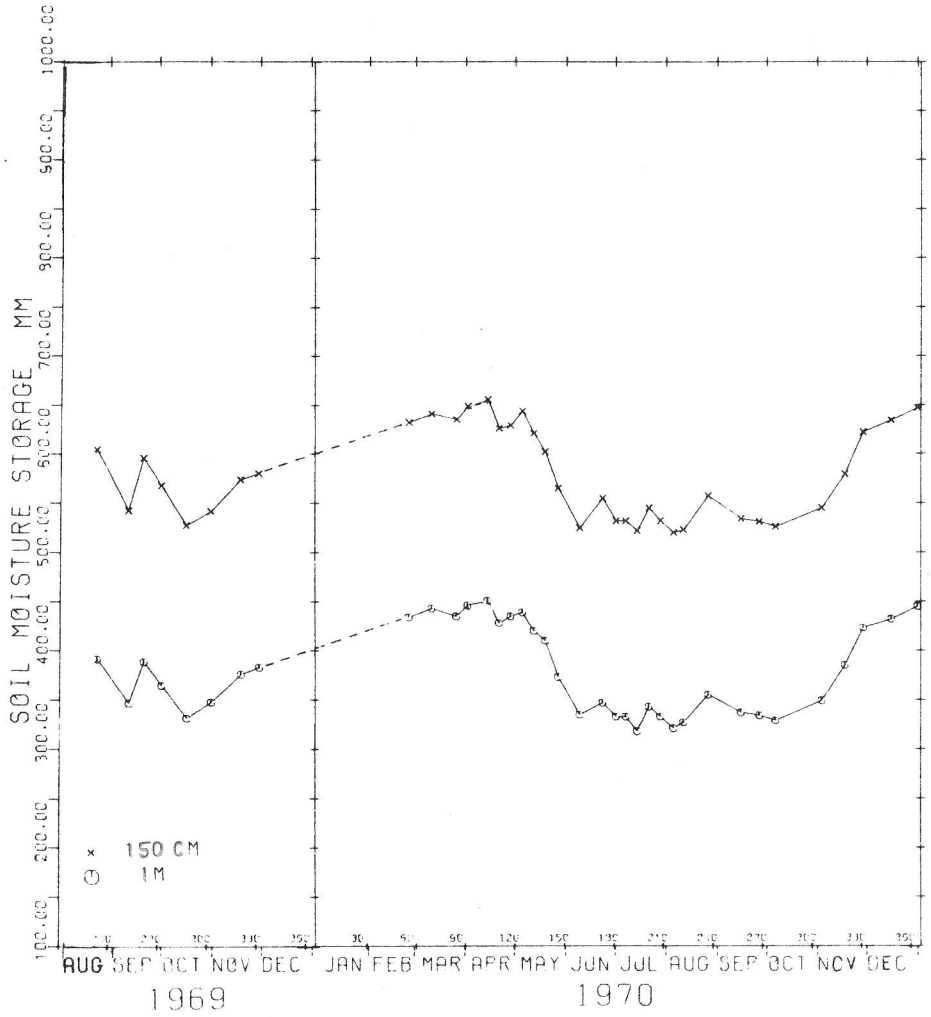


FIGURE 76a

Site: T5
PM Texture: CLAY
Soil: SURFACE WATER GLEY (ROWSHAM)
Landuse: PERMANENT PASTURE

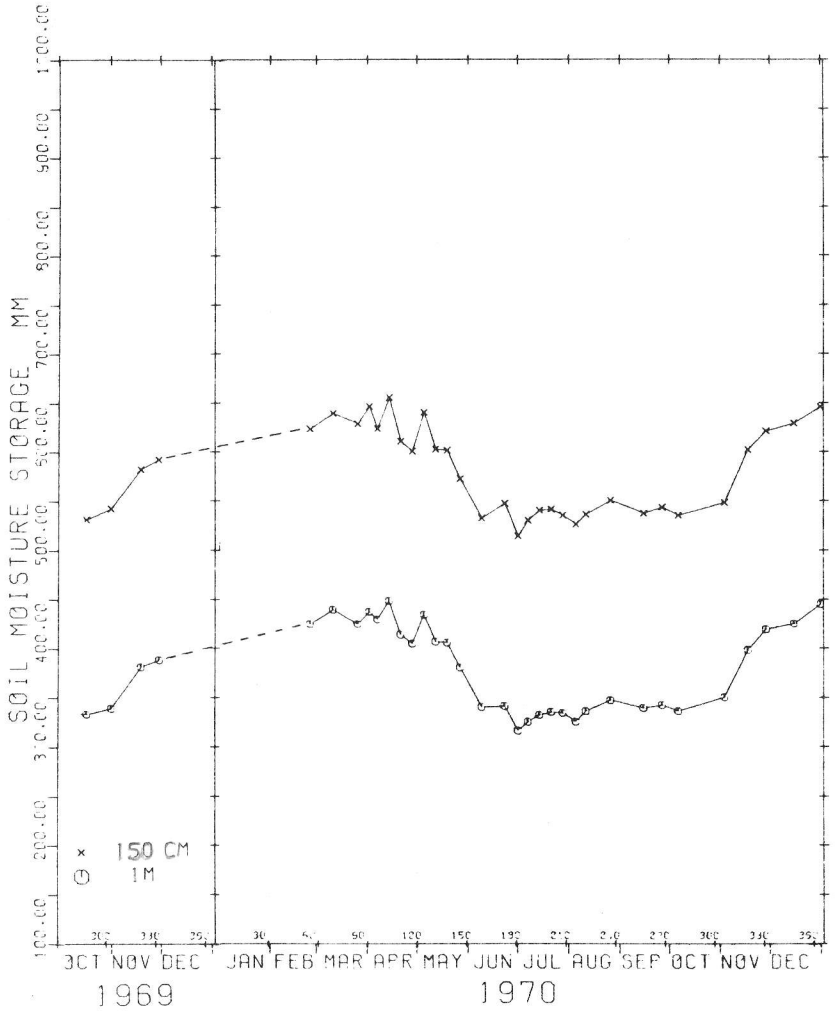


FIGURE 76b

Site: T6
PM Texture: CLAY
Soil: SURFACE WATER GLEY (ROWSHAM)
Landuse: PERMANENT PASTURE

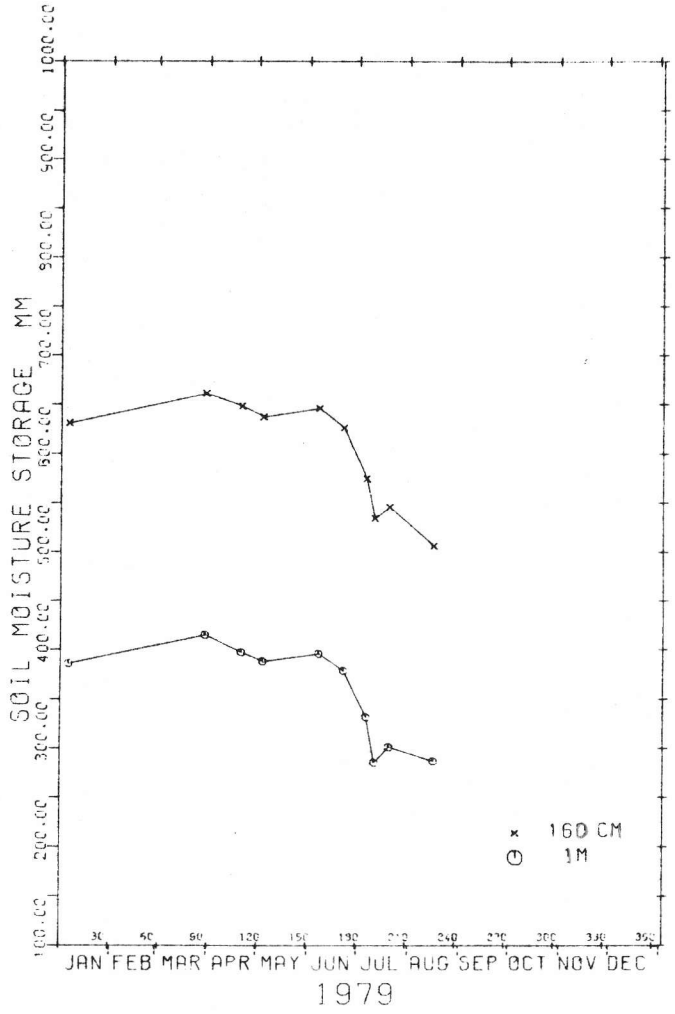


FIGURE 77a

Site: S1
PM Texture: CLAY
Soil: SURFACE WATER GLEY (HILDENBOROUGH)
Landuse: WINTER WHEAT

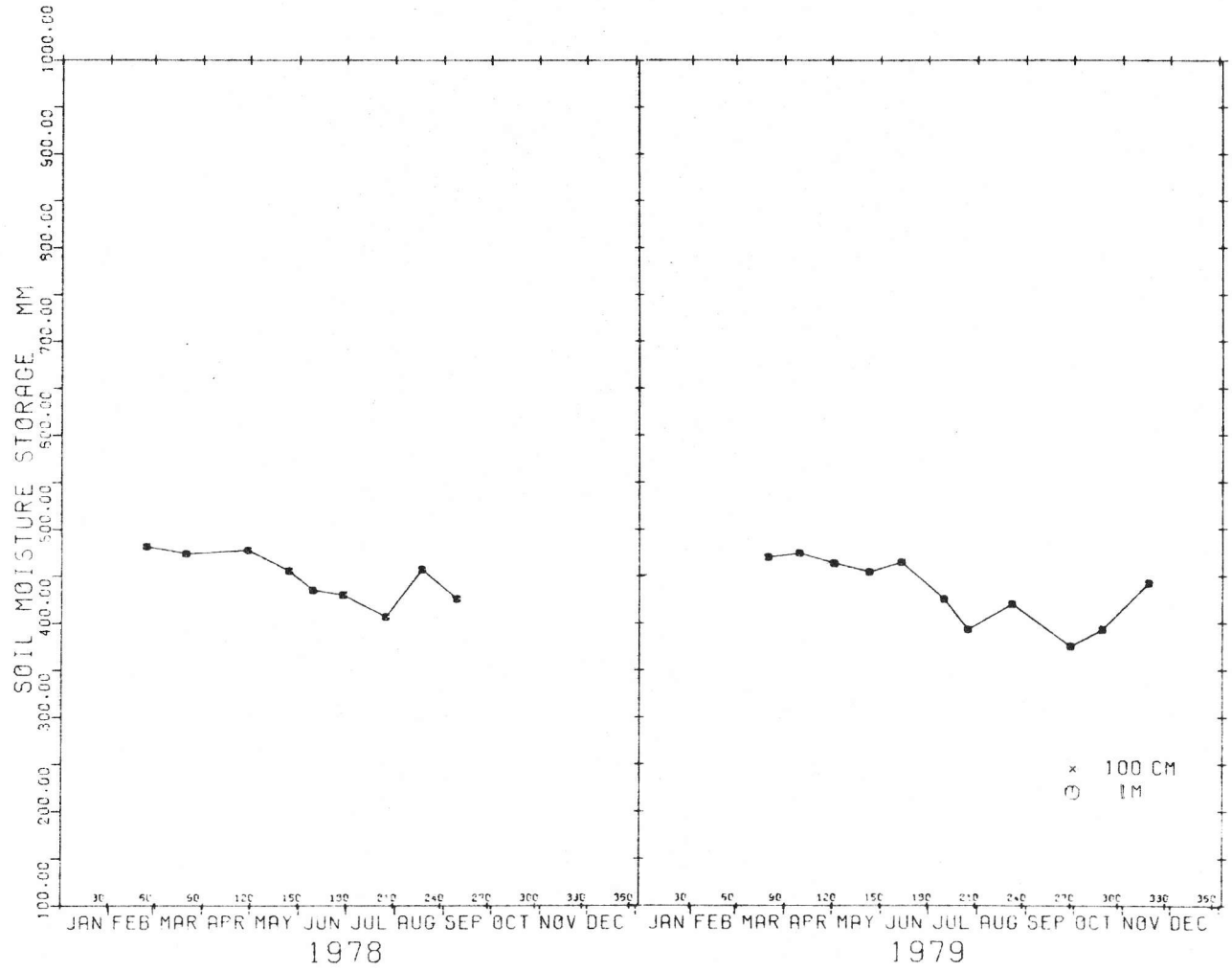


FIGURE 77b

Site: I1
PM Texture: CLAY DRIFT
Soil: SURFACE WATER GLEY (CREWE)
Landuse: PERMANENT GRASS

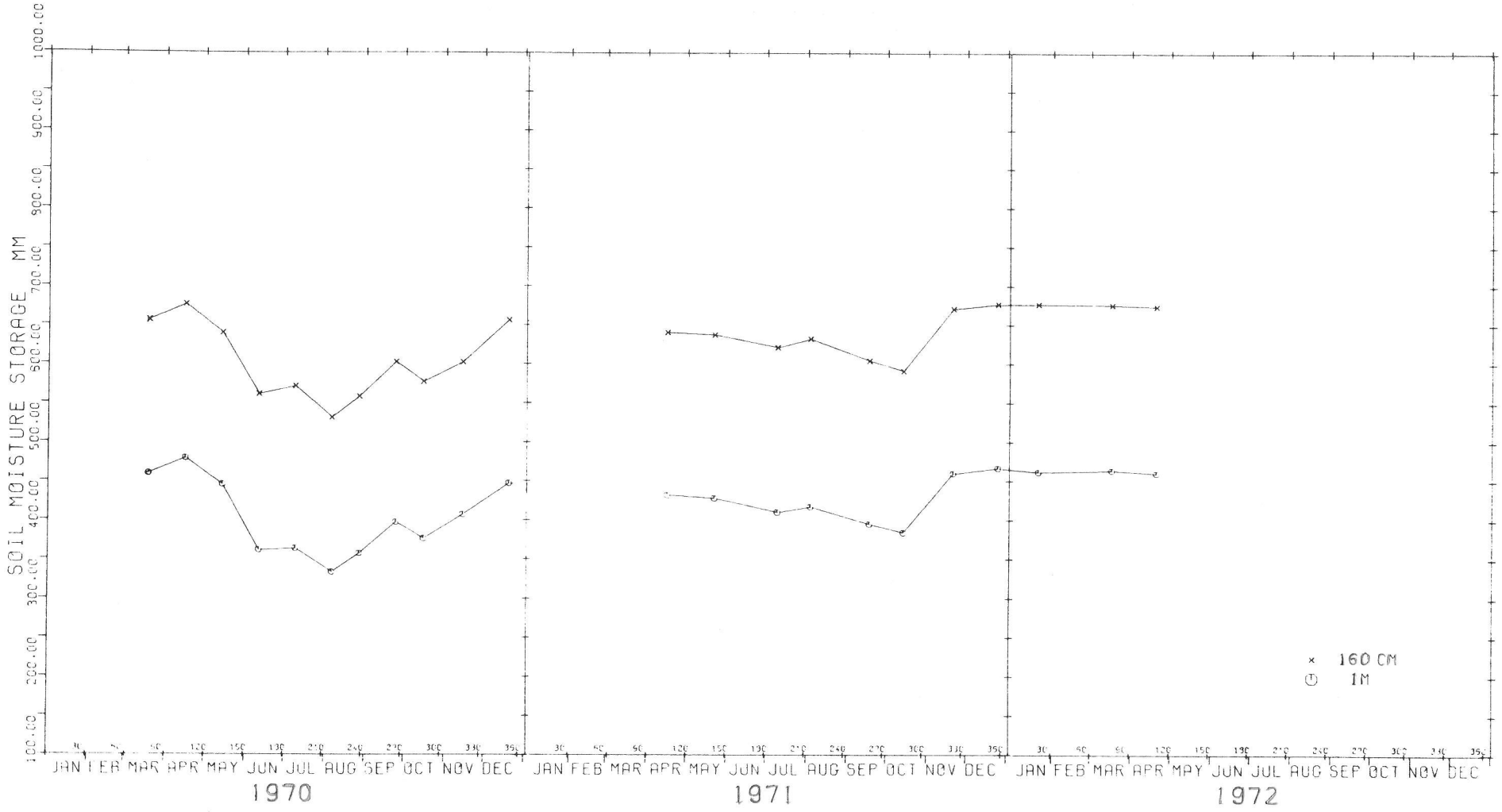


FIGURE 78

Site: T11 **PM Texture:** CLAY **Soil:** SURFACE WATER GLEY (HANSLOPE) **Landuse:** PERMANENT PASTURE

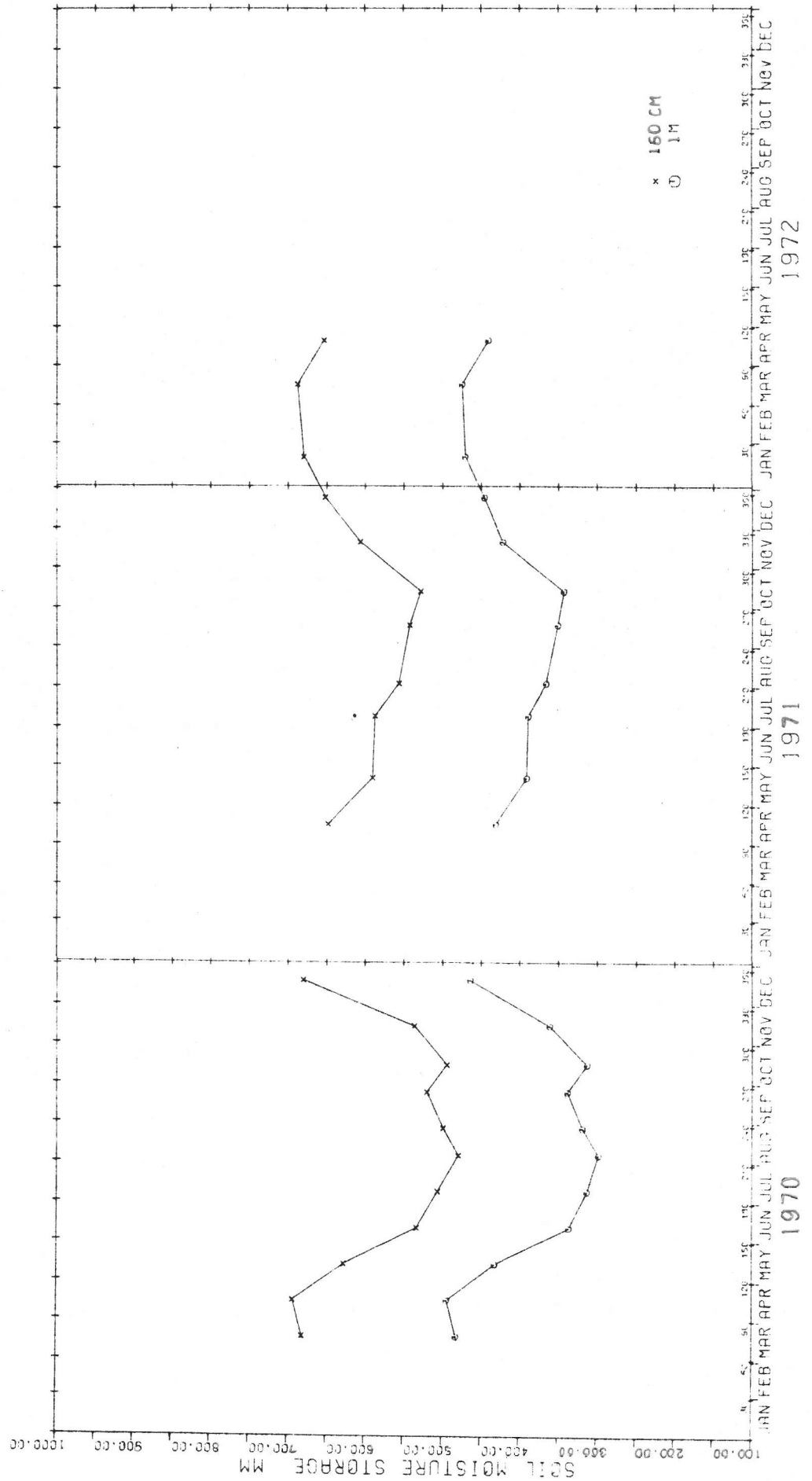


FIGURE 79

Site: T12 **PM Texture:** CLAY **Soil:** SURFACE WATER GLEY (HANSLOPE) **Landuse:** PERMANENT PASTURE

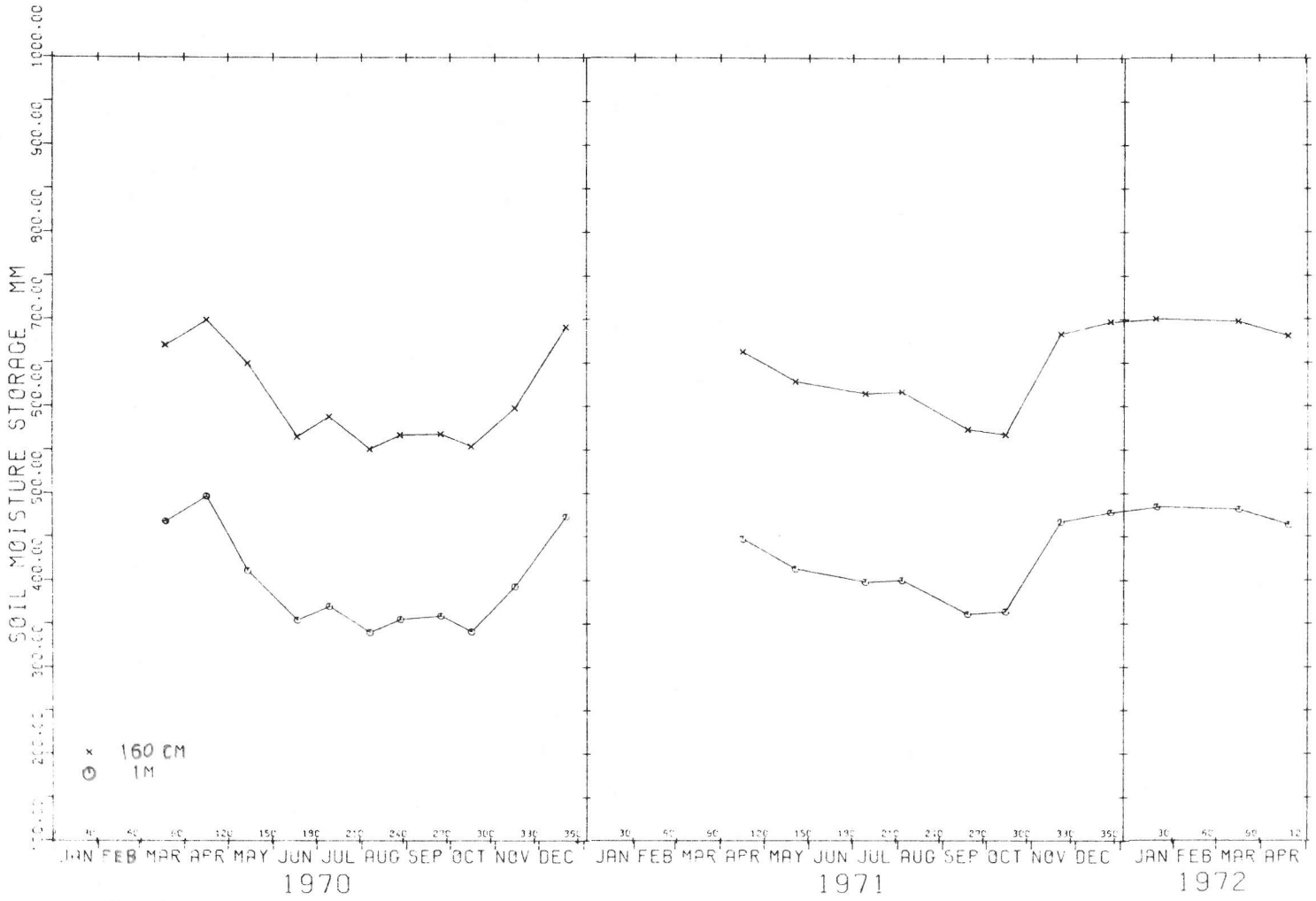


FIGURE 80

Site: T13 PM Texture: CLAY Soil: SURFACE WATER GLEY (HANSLOPE) Landuse: PERMANENT PASTURE

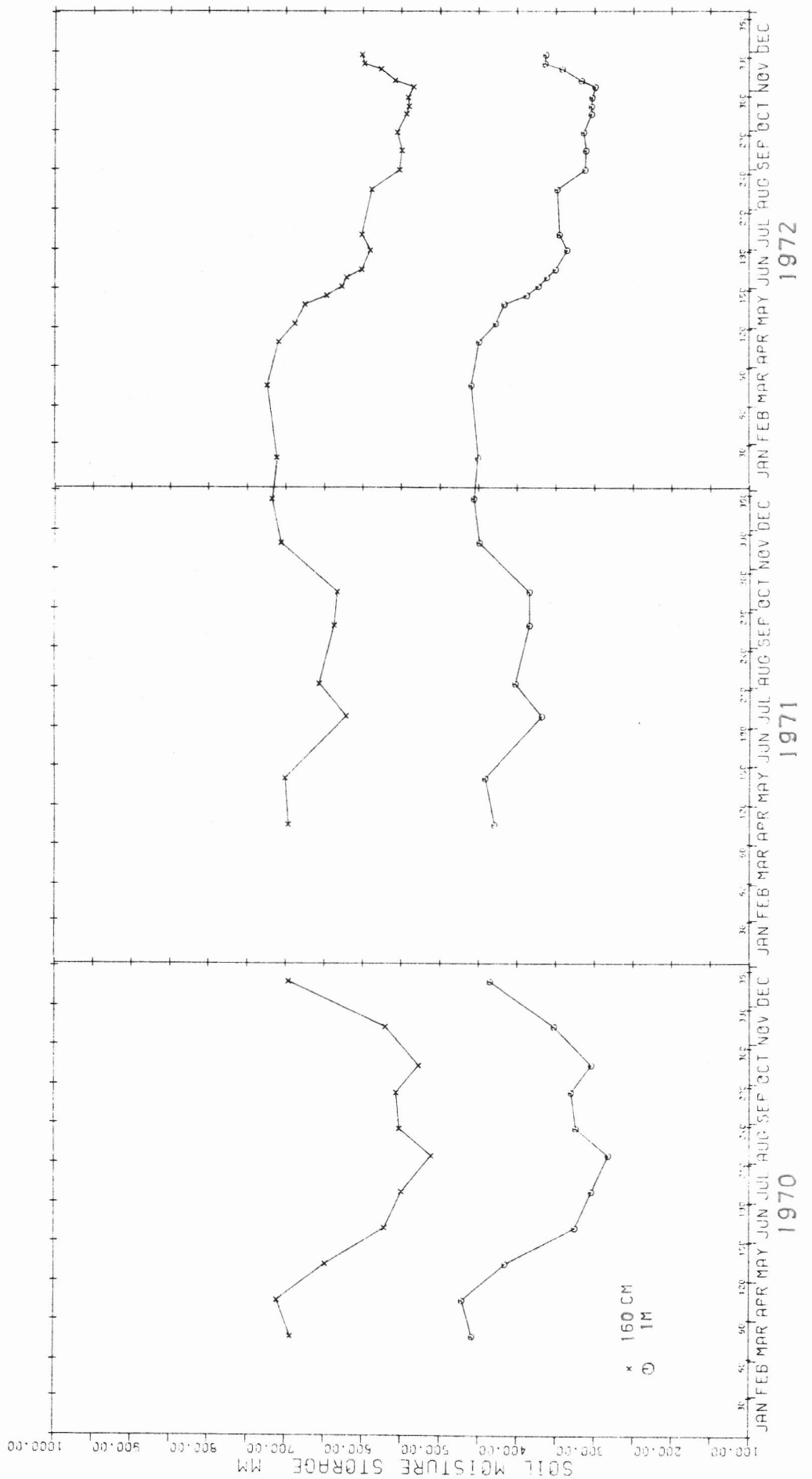


FIGURE 81

Site: T14 **PM Texture:** CLAY **Soil:** SURFACE WATER GLEY (HANSLOPE) **Landuse:** GRASS

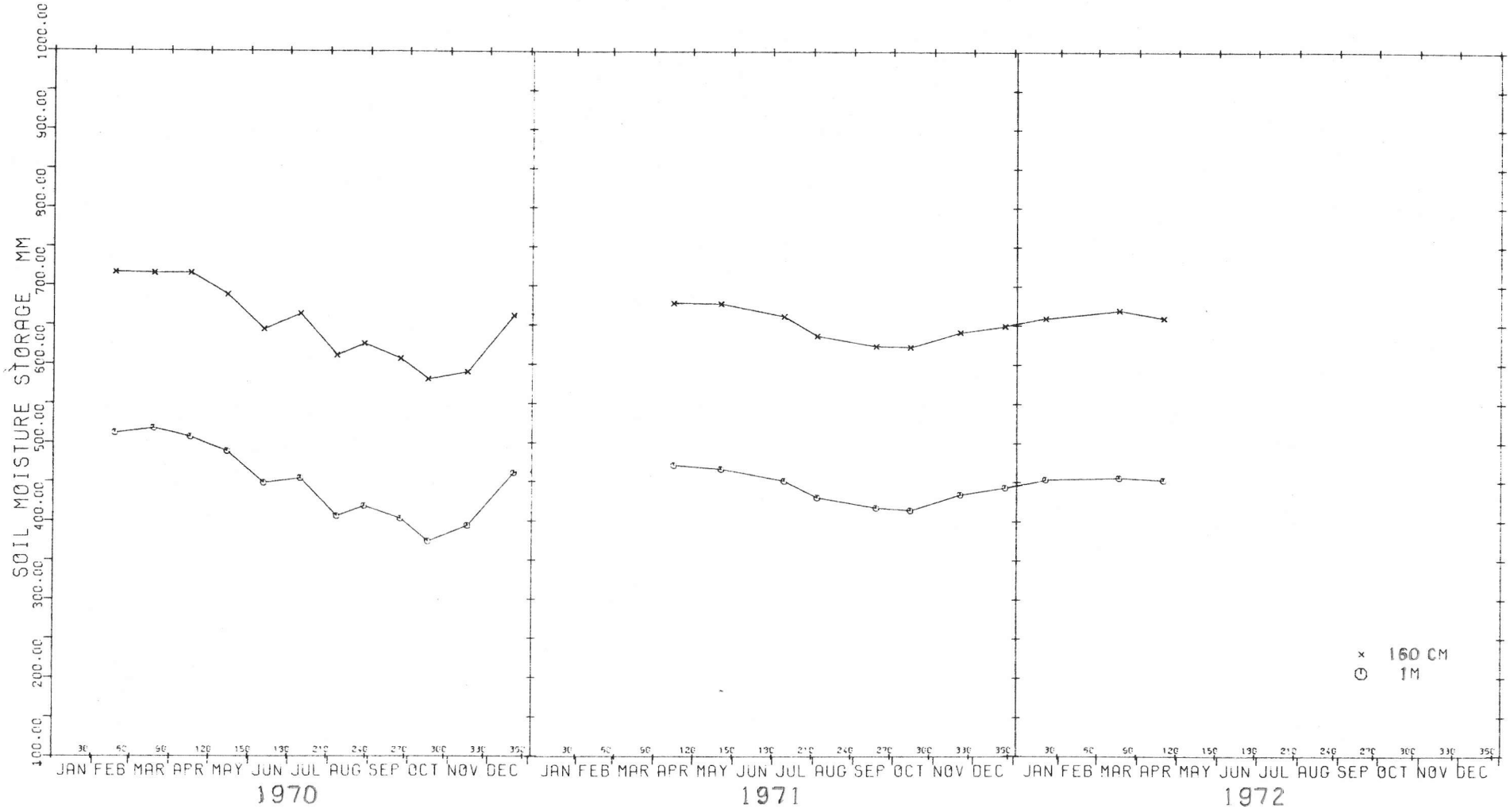


FIGURE 82

Site: T8 **PM Texture:** CLAY ALLUVIUM **Soil:** GROUNDWATER GLEY (RIB) **Landuse:** PERMANENT PASTURE

6. SITE DESCRIPTIONS

The following descriptions of the individual sites are brief but intend to provide enough information for most purposes of the databank user. Tables 3 and 4 and Figures 2 and 3, (Section 5) may be used as a guide to the site descriptions for they are arranged by site group, this is indicated in the site code. Table 5 list the page numbers of the site group details which precede the site descriptions for each group.

For each site group, information concerning neutron probe use, including the calibration procedure used by the investigator, is given. The calibrations are written in one or other of the following forms depending whether a count in a water standard was used.

$$MVF = aR/R_w + b \qquad MVF = aR + b$$

MVF = Moisture Volume Fraction
R = Neutron count rate in soil
R_w = Neutron count rate in water standard
a and b are constants

The details of each site include its Grid Reference, its approximate elevation above sea level and details of its topographic setting. The landuse of each site is described and the nature of the soil. Emphasis is placed on those features of the soils which influence their moisture regime, in particular the texture of their parent material. For many of the sites the soil series to which the soils belong had been identified and references to appropriate descriptions of these series by the soil surveys of England and Wales, and of Scotland, are provided. At a few sites the soils were only tentatively assigned to soil series in which case this is indicated in the site descriptions.

TABLE 5

SITE GROUP: A

INVESTIGATOR: Dr C E Mullins
Dept. of Soil Science, University of Aberdeen

OBJECTIVES

The data were recorded by a research student working under Dr Mullins on a project which aimed to characterize the soil moisture regime of adjacent experimental plots, growing spring barley, which had been variously subsoiled, mole drained or not treated (Hla Htun 1975).

OPERATIONAL DETAILS

Frequency and period of readings: Every 4 days on average, from June 1974 to the end of the growing season, then monthly to the end of the year. Several readings were also made during the 1975 growing season but on a more erratic basis.
Reading depths: At 10 cm intervals to a maximum depth of 90 cm.
Calibration: A field calibration was prepared though with some difficulty due to the stoniness of the site soil. A separate calibration was determined in the field for the 10 cm readings as listed below.

	a	b	
10 cm	0.00109	-0.5	MVF = aR + b
20 + cm	0.0007757	-0.5	

SITE DESCRIPTION

SITES: A1, A2, A3, A4.
Grid Ref: NJ905233 *Elevation:* 99 m
Soil: Gley (Pitmedden) *PM Texture:* Clayey drift
Landuse: Arable (Experimental plots)

The experimental plots were located in Green's field on the University of Aberdeen's farm at Tilly Corthie, about 17 km north of Aberdeen. There is a copse to the north-east of the field, which slopes gently (<5°) in a north-easterly direction, but the sites were fairly well exposed. The moling and sub-soiling were carried out in 1971 but by 1975 it appeared that the mole drains had collapsed. Ten access tubes in two lines of five were installed in each plot, but the data from a line in both the control and moled plots were discarded. The means of each of the remaining 4 groups of 5 have been included in the databank. The treatments were as follows:

A1 Control Plot
A2 Mole drained, 1.8 spacing, 55 cm deep (nb mole drains probably ineffectual when work done.
A3 Subsoiled, 1.8 m spacing, 65 cm deep
A4 Subsoiled, 1.8 m spacing, 65 cm deep

Soil: The soil is a surface water gley of the Tarves Association developed on till (Glentworth and Muir 1963). Two detailed profile descriptions in the vicinity of the plot are available (Hla Htun 1975) and indicate that the soils are of the Pitmedden series. A loam horizon (0 to 20 cm) overlies gleyed sandy clay loam horizons with large structures above the massively structured sandy clay loam till.

Crop: All the plots were sown to spring barley; the cultivation and crop development sequence in 1974 was as follows: cultivation 6 April; barley sowing, 8 April; emergence, 19 April; heading, between 5 July and 28 August; harvest, 18 September.

SITE GROUP: B

INVESTIGATOR: Dr G Buchan
Macaulay Institute for Soil Research, Aberdeen

OBJECTIVES

Eight access tubes were installed in the grounds of the research station in 1977 to monitor soil moisture changes there and permit experience to be gained with the then new probe.

OPERATIONAL DETAILS

Frequency and period of readings: Approximately weekly from mid-April to mid-September in 1977.

Reading depths: 10 cm intervals to between 40 and 70 cm. An indurated B_3 horizon prevented deep installation of access tubes.

Calibration: A calibration for the Countesswells soil series was established using field calibration data from both the Macaulay site and another nearby. A separate calibration was determined for readings at 10 cm depth as shown below

	a	b	
10 cm	0.958	-0.0394	$MVF = aR_{/R_w} + b$
20 cm +	0.922	-0.034	

SITE DESCRIPTION

SITES: B1, B2, B3, B4, B5, B6, B7, B8

Grid Ref: NJ905045 *Elevation:* 76 m

Soil: Podzol (Countesswells) *PM Texture:* Sandy drift

Landuse: Grass and arable

The access tubes were located in three fields which adjoin one another but are surrounded by woodland and housing on all sides. They were towards the centre of this clearing, on the flat summit of a low rise and so above the woodland. Gentle slopes (5°) bound the rise on all sides.

Soil: The soil is of the Countesswells series (Glentworth and Muir 1963), a cultivated podzol of sandy loam texture developed on a sandy loam, stony granitic till. The series is characterised by the indurated B_3 horizon which hinders root development. At this site the B_3 has not caused gleying above it indicating that it is not as impervious as elsewhere.

Crops: The list below indicates the crop cover at each access tube:

A1	Grass
A2	No crop - bare soil
A3, A4, A5	Spring barley - no nitrogenous fertiliser
A6, A7, A8	Spring barley with nitrogenous fertiliser

SITE GROUP: C

INVESTIGATOR: J R Bevan
Dept. of Geography, Newcastle-upon-Tyne Polytechnic

OBJECTIVES

This neutron probe work was conducted as part of a study of the water balance of the Whapweasel Catchment on the Hexham moors in south-west Northumberland. A total of 15 access tubes were installed but most were very shallow and located on a particularly steep slope. Only the data from two sites on the more typical undulating moorland have been included in the databank.

OPERATIONAL DETAILS

Frequency and period of readings: Approximately weekly throughout 1977 and 1978
Reading depths: From 10 cm at 10 cm intervals to 130 cm (C1) and 150 cm (C2)
Calibration: A field calibration was conducted which gave the following equation

MVF = 0.000629 R+ 0.033163

By comparing the normal count rate at 10 cm depth with that measured when a tray of soil was placed on the ground surface above, so increasing the distance to the air interface, the following equation was derived and used to modify the normal 10 cm depth reading:

$$R_{corrected} = 0.9959\ R_{measured} + 44.4138$$

SITE DESCRIPTION

SITES: C1 and C2

Grid Ref: NY880570 *Elevation:* 310 m
Soil: Peaty gley (Wilcox-Belmont) *PM Texture:* Clayey drift
Landuse: Heather moorland

Both access tubes were located near the crest of a very steep slope from the fairly flat plateau-like moorland surface, to the bottom of the deeply incised valley of the Whapweasel Burn. No shelter was available to either site. C1 was installed approximately 10 m north of the crest of the valleyside slope. The site sloped gently (<5°) southwards and was vegetated mainly by heather which was recovering from burning in 1975. C2 was located about 5 m from the top of the valleyside in an area of heather vegetation with occasional patches of bare peat surface. The site also sloped gently southward but drainage from it was almost certainly influenced by the proximity of the steep valleyside slope.

Soil: The moorland is underlain by a sandy clay drift on sandstone. The soils there are mapped as peaty gleys and peaty gleyed podzols of the Wilcox-Belmont complex (Jarvis 1977). However inspection of a soil exposure at the nearby crest of the valleyside slope indicated that the soil at the sites could be more freely draining than many of this complex. Although peaty at the surface, there was no evidence of gleying in the lower horizons; ie it was more podzolic in character. Peat approximately 12 cm thick overlay a pale 15 cm deep sandy loam horizon above the very stony drift comprising large sandstone fragments in a sandy clay matrix.

SITE GROUP: D

INVESTIGATOR: A Gustard
Dept. of Environmental Sciences, Lancaster University
(Now at Institute of Hydrology)

OBJECTIVES

A neutron probe was used to monitor soil moisture changes in two small Lancashire catchments adjacent to the M6 motorway as part of a project conducted for the Transport and Road Research Laboratory. Fuller details of the catchments are available in Patrick and Gustard (1975).

OPERATIONAL DETAILS

Frequency and period of readings: Weekly from October 1973 until July 1974
Reading depths: At 15 cm intervals from 15 cm depth to the base of the access tubes. The soil at several of the sites was very shallow and underlain by hard rock; the depth to which the individual access tubes were installed reflected this.
Calibration: A field calibration was conducted. However it was found to be very similar to that for clay soils determined by the Institute of Hydrology and it was subsequently adopted. No surface calibration was used.

SITE DESCRIPTIONS

SITES: D1, D2, D3, D4, D5

This group of access tubes were located in the catchment of the Burnes Gill, a small stream which drains from a north-east facing corrie and meets the river Lune 4 km south of Tebay. The local geology is of silurian slates, shales and grits and the shallow soils developed in the catchment are probably of the Brantwood Association (Hall and Folland 1970)

SITE: D1

Grid Ref: NY606005 *Elevation:* 270 m
Soil: Gleyed brown earth *PM texture:* Sandy clay
Landuse: Rough grazing

This site was on a steep , 20°, east facing slope overlooking the Lune Valley.

Soil: The soil on this slope is a gleyed brown earth. A shallow (10cm) humose clay horizon overlies a 40 cm deep sandy clay layer above a mottled stony sandy clay.

SITES: D2, D3

Grid Ref: NY604004 *Elevation:* 270 m
Soil: Surface water gley *PM Texture:* Sandy clay
Landuse: Rough grazing

Both sites were on the valley floor which slopes at about 10° to the north east. D3 was towards the head of the valley and D2 was its northern end.

Soil: The soil in the valley is a shallow, stony, surface water gley. There is a shallow organic horizon above a 30 cm deep stony sandy clay layer which is underlain by a very stony sandy clay. (Patrick and Gustard 1975).

SITE: D4

Grid Ref: NY604007 *Elevation:* 300 m
Soil: Brown earth *PM Texture:* Sand
Landuse: Rough grazing

This access tube was installed on a steep (30°) south east facing slope overlooking the valley.

Soil: The soil was a shallow, sandy brown earth. A 10 cm deep organic horizon overlay a stony sandy loam horizon which below 65 cm depth merged to weathered rock material.

SITE GROUP: D (continued)

SITE: D5

Grid Ref: NY608003 *Elevation:* 210 m

Soil: Surface water gley *PM Texture:* Sandy clay

Landuse: Permanent pasture

This access tube was installed on a gentle slope (10°) in a field of permanent pasture adjacent to the A685. The aspect was eastward.

Soil: The soil was a shallow surface water gley comparable to that described for the valley floor (D2, D3).

SITES: D6, D7, D8, D9

These 4 sites were located to the west side of the M6 between Shap and Tebay. A tributary of the Force Beck drains the gentle eastward slope which is underlain by sandstone and sandy clay drift. The soils are similar to those which have been called the Rivington Association (Hall and Folland 1970)

SITE: D6

Grid Ref: NY574122 *Elevation:* 330 m

Soil: Gleyed brown earth *PM Texture:* Sandy clay drift

Landuse: Heather moorland

The site was on a gentle (5°) slope vegetated predominantly by heather and bilberry.

Soil: The soil on the slope has a humose sandy loam surface horizon (0 - 6 cm) which overlies a sandy loam horizon (6 to 30 cm) below which is a slightly mottled sandy clay horizon. Weathered sandstone occurs at a depth of between 80 and 100 cm.

SITES: D7, D8 and D9

Grid Ref: NY579125 *Elevation:* 310 m

Soil: Surface water gley *Texture:* Sandy clay drift

Landuse: Heather moorland

The three sites were located downslope from D6. The ground here slopes very slightly to the north east. The area supports a vegetation of heather and bilberry with some rushes.

Soil: The soil in the area is a surface water gley (Patrick and Gustard 1975). The clayey drift parent material is responsible for the impeded drainage of the profiles. Generally a 10 cm deep humose clay surface horizon is underlain by a shallow (15 cm) slightly mottled clay which merges to a more strongly mottled clay horizon. Site D7 was in a slight undulation and notably more frequently waterlogged than the adjacent sites.

SITE GROUP: E

INVESTIGATOR: D G M Hall
Soil Survey, Shardlow.

OBJECTIVES

Soil moisture data representing several soil series have been collected at six sites in Lincolnshire for the purpose of comparing the soil moisture regime of the different soil series. Some of the data have been used in a comparison of measured soil moisture deficits with estimates prepared by both a Meteorological Office Model and a MAFF model (Hall and Heaven 1979).

OPERATIONAL DETAILS

Frequency and period of readings) listed below with corresponding site details
Reading depths:)

Calibration: The readings obtained with the probe were compared with those recorded with a probe owned by the Nottingham University School of Agriculture, at Sutton Bonnington, and found to be very similar. A calibration had been conducted for the latter and this was adopted for Soil Survey's probe. The calibration adopted included separate equations for use with readings taken at 10 and 20 cm.

	a	b	
10 cm	0.000673	+0.0388	MVF = aR + b
20 cm	0.000786	-0.0077	
30+ cm	0.000805	-0.018	

SITE DESCRIPTIONS

SITES: E1, E2, E3 and E4

Four sites each with a pair of access tubes were established in Lincolnshire in April 1974 and monitored for two years. Two of the sites were on Nocton Fen 15 km south-west of Lincoln. The others were on the chalk wolds to the north east of Lincoln.

Frequency and period of readings: Fortnightly from April 1974 through to March 1976.

Reading depths: 10 cm depth intervals from 10 cm to 150 cm at the fenland sites and to 90 cm at the chalk wold sites.

SITE: E1

Grid Ref: TF110678 *Elevation:* 2 m
Soil: Gley (Downholland) *PM Texture:* Clayey alluvium
Landuse: Arable

The two access tubes were located in a level arable field which was bounded by large drainage ditches.

Crop: The crop cover changed in the course of the measuring period from winter wheat which was harvested in late August 1974, to stubble which was ploughed early in October that year. Then in 1975 a crop of peas was sown in April and subsequently harvested in mid-July. In early October 1975 a winter wheat crop was sown.

Soil: The soil at the site is a groundwater gley developed on drained clayey fen alluvium. The A horizon (0 to 23 cm) is a humose clay loam and overlies a gleyed silty clay horizon which extends to 82 cm depth. Between 82 and 92 cm is a semi-fibrous peat horizon, the organic A horizon of a buried soil. Below it the horizons of the buried soil are sand textured. The profile is well drained and the water level is usually maintained below 60 cm. The Downholland series has been described in this area by Robson et al (1974).

SITE GROUP: E (continued)
SITE: E2
Grid Ref: TF113666 *Elevation:* 2 m
Soil: Groundwater gley (Romney) *PM Texture:* Loamy alluvium
Landuse: Arable

The site was in a flat fenland location 1 km to the south of El.

Crop: The crop was initially winter wheat which was harvested at the end of August 1974. The field was then ploughed in the second week of October 1974 and in March the following year sown with sugar beet. This crop was harvested in mid-November and followed by winter wheat, sown at the end of December.

Soil: The soil is an example of the Romney series of groundwater gleys developed upon silty alluvium of estuarine and marine origin (Robson et al 1974). The uppermost horizon is a humose silty clay loam. Below, from 32 to 46 cm, is a silty clay loam horizon and then from 46 to 69 cm a silt loam with thin clay bands This overlies a sandy loam with fine clay bonds. The Romney series are permeable soils so long as the water level is held quite deep.

SITE: E3
Grid Ref: TF279825 *Elevation:* 129 m
Soil: Rendzina (Andover) *PM Texture:* Chalk
Landuse: Permanent pasture

The site was located in a field just east of South Farm near Donnington-on-Bain. The field slopes gently to the south west from the north east corner, where the access tubes were located then dips steeply down to a small dry valley. Woodland on the east side of the field and a hedge bounding it to the north will have sheltered the site to some extent.

Soil: The soil is very shallow; chalk rubble becomes dominant at a depth of 20 cm. The A horizon is of silty clay loam texture. It is an example of the Andover series of brown rendzinas (Jarvis 1973). The parent material at this site is Middle Chalk.

SITE: E4
Grid Ref: TF210862 *Elevation:* 125 m
Soil: Rendzina (Andover) *PM Texture:* Chalk
Landuse: Permanent pasture

The access tubes were located on a gentle 2^{o} south east facing slope. This site was 1 km west of Burgh on Bain.

Soil: The soil is an example of the Andover series of brown rendzinas (Jarvis 1973) and comprises a horizon of stony silty clay loam overlying fractured chalk rock. The boundary between the soil and the chalk is at 28 cm. The parent material is Lower Chalk.

SITE: E5, E6

These two sites were situated to the east of Willoughton on the limestone outcrop. Two access tubes were installed at the sites; the mean of the readings from each pair were included in the databank.

Frequency and period of readings: Fortnightly between February 1977 and October 1978.
Reading depths: At 10 cm intervals from 10 cm to 80 cm depth
SITE: E5
Grid Ref: SK946932 *Elevation:* 56 m
Soil: Rendzina (Sherborne) *PM Texture:* Limestone
Landuse: Arable

SITE GROUP: E (continued)
The pair of access tubes were in a flat open field on Cliff House farm

Crop: The field was down to a ley for the first part of the measuring period but in early May 1978 it was ploughed and a potatoe crop was planted.

Soil: The soil at the site was an example of the Sherborne series of shallow rendzinas developed upon Jurassic limestones (Avery 1955). The very well drained profile is typically clay or clay loam in texture.

SITE: E6
Grid Ref: SK955925 *Elevation:* 46 m
Soil: Rendzina (Sherborne) *PM Texture:* Limestone
Landuse: Arable

The site was in an open arable field near to E5 and had a gentle (3°) eastward slope.

Crop: During the growing season of 1977 a crop of winter wheat was cultivated. It was harvested in mid-September. The field was ploughed during November and then in late April 1978, a pea crop was planted. This was harvested in the second week of July and immediately followed by a mustard crop.

Soil: The soil was also an example of the rendzinas of the Sherborne series (Avery 1955).

SITE GROUP: F

INVESTIGATOR: G Chubb
Severn-Trent Water Authority, Trent Area Unit
Nottingham.

OBJECTIVES

The data was collected as part of a two and a half year investigation of soil moisture regimes in the Doverbeck catchment, a small catchment which drains south-eastwards from the Bunter sandstone outcrop into the river Trent, approximately 15 km east of Nottingham. In total 12 pairs of access tubes were installed throughout the catchment. The data from only 10 of the sites have been included in the databank; the mean of the data from each pair of tubes was used.

OPERATIONAL DETAILS

Frequency and period of readings: Monthly or more frequently, commencing in June 1975 and continuing until October 1977.
Reading depths: At 10 cm intervals from the surface to depths of 140 to 250 cm depending on how difficult it was to install the access tubes. The series of readings began at different depths at different sites.
Calibration: No calibration was prepared for the sites and so the appropriate Institute of Hydrology calibrations were used.

SITE DESCRIPTION

SITE: F1

Grid Ref: SK658480 *Elevation:* 35 m
Soil: Gleyed brown earth (Ollerton complex) *PM Texture:* Sandy alluvium/colluvium
Landuse: Mown grass

The access tubes were installed in an area of rough grass in the grounds of Epperstone Pumping Station. The site is almost level being upon the colluvium-alluvium just below the break of slope at the valleyside. The site is probably sheltered to the north east by the valleyside slope and to the north west by a hedgerow of tall trees about 15 m away. The rough grass sward was mown quite frequently

Soil: The soil is probably an example of the gleyed brown earth phase of the Ollerton complex of gleyed soils. These soils occur on sandy gravelly alluvium derived from the Bunter Sandstone (Robson and George 1971). At the site the textural horizonation of the profile was as follows: 0 to 30 cm, sandy loam; 30 to 50 cm, sandy loam with mottling; 50 cm plus, stony mottled loam.

SITE: F2

Grid Ref: SK658482 *Elevation:* 35 m
Soil: Gleyed brown earth (Ollerton complex) *PM Texture:* Sandy alluvium/colluvium
Landuse: Permanent pasture

Located in a field on the north westside of site F1 in permanent pasture, this site was very similar to site F1, level, but sheltered by the line of trees on its east side.

Soil: The soil was also an example of the Ollerton complex gleyed brown earths (see F1)

SITE: F3

Grid Ref: SK659477 *Elevation:* 30 m
Soil: Gley (Ollerton complex) *PM Texture:* Sandy alluvium
Landuse: Permanent pasture

This site was to the south east of the Epperstone Pumping Station about 40 m from the Dover beck. The access tubes were protected in a small fenced enclosure located adjacent to the hedge of a field of permanent pasture. The hedge probably afforded some shelter to the site.

SITE GROUP: F (continued)

Soil: The soil was probably an example of a ground water gley of the Ollerton Complex (Robson and George 1971). The texture of the surface horizons was sandy loam and given its proximity to the stream, its lower horizons must be very gleyed. The height of the water table varied from 20 cm to 350 cm during the recording period

SITE: F4

Grid Ref: SK649477 *Elevation:* 46 m
Soil: Gley (Ollerton complex) *PM Texture:* Sandy alluvium/colluvium
Landuse: Unkempt grass

The site was located in the uncultivated corner of a field of a market garden. It was almost level being upon the alluvial and colluvial material accumulated at the side of the valley floor. It was vegetated by grass and a variety of weeds and sheltered by a hedge about 5 m away on the north side.

Soil: The soil was another example of the Ollerton complex of groundwater gleys (see above). The texture of the soil horizon was as follows: 0 to 20 cm, fine sandy loam susceptable to surface panning; 20 to 45 cm, structureless sandy loam; 45 cm plus, loamy sand.

SITE: F5

Grid Ref: SK649475 *Elevation:* 60 m
Soil: Brown earth (Hodnet) *PM Texture:* Loam
Landuse: Unkempt grass

This site was located about 100 m up slope from F4 on the lower slope of the north-west facing valley side. The site was exposed in all directions and located in an area of uncultivated weedy ground in the middle of the nursery.

Soil: An example of the Hodnet series of brown earths, the soil profile was described as follows: 0 to 20 cm silt loam; 20 to 50 cm, silt loam with few black manganiferous corrections; 50 cm plus, silty clay loam of firm consistency. These soils, described by Robson and George (1971) occur on the interbedded marls, siltstones and sandstones of the Keuper Waterstone and are moderately or well drained. The profile, with some evidence of temporary waterlogging might alternatively be assigned to the Hodnet complex of gleyed brown earths.

SITE: F6

Grid Ref: SK639480 *Elevation:* 45 m
Soil: Gleyed brown earth (Hodnet complex) *PM Texture:* Loam
Landuse: Unkempt grass

This site was located in a nursery garden to the west of Woodborough on the gentle lower east facing valley side slope. The access tubes were installed in an uncultivated weedy corner of a field and sheltered by high bushes about 10 m to their west side.

Soil: The soil was probably an example of the Hodnet complex of gleyed brown earths developed upon Keuper waterstones (see F5).

SITE: F7

Grid Ref: SK641478 *Elevation:* 40 m
Soil: Gley (Ollerton complex) *PM Texture:* Sandy alluvium
Landuse: Unkempt grass

Situated on alluvium within 20 m of a small tributary to the Dover beck, this site was flooded intermittantly during the wintermonths. It was almost due east of F6 but on the opposite side of the stream. The site was vegetated by grass and weeds and partially sheltered to the west by trees adjacent to the stream.

SITE GROUP: F (continued)

Soil: The soil was similar to that of the flood plain site at Epperstone, F3, ie. a groundwater gley of the Ollerton complex developed in sandy alluvium.

SITE: F8

Grid Ref: SK633502 *Elevation:* 61 m
Soil: Brown earth (Hodnet) *PM Texture:* Loam
Landuse: Woodland

This was a moderately sloping site (6^{o}) in a lower valley side slope position located at the edge of Epperstone Park Wood. The vegetation is grass and bracken below deciduous trees.

*Soil:*Another brown earth of the Hodnet series similar is that at site F5 and developed on the Keuper Waterstone. A 25 cm deep surface horizon overlay 45 cm of very slightly mottled silt loam.

SITE: F9

Grid Ref: SK613544 *Elevation:* 91 m
Soil: Podzol (Crannymoor) *PM Texture:* Sandstone
Landuse: Mown grass

Far Baulker pumping station is located in an exposed position just below the crest of the Bunter sandstone escarpment 2 km north west of Oxton. The access tubes were installed in the mown grass of the grounds on the east side of the station.

Soil: The soil was assigned to the Crannymoor series of podzols but it had evidently been cultivated and organic A horizon destroyed. The Crannymoor series is characteristic of the Bunter sandstone and the profile was of loamy sand texture (Robson and George 1971).

SITE: F10

Grid Ref: SK611545 *Elevation:* 90 m
Soil: Podzol (Crannymoor) *PM Texture:* Sandstone
Landuse: Coniferous wood

This site was near to F9 but 8 m within the forestry commission plantation of conifers to the north side of the pumping station. The access tubes were midway between two trees, about 3 m from each. The trees are mature and there is an understorey of grass, bracken and bramble and a deep litter of twigs and pine needles. The site slopes gently to the north west.

Soil: A very typical example of the Crannymoor series of podzols. The texture of the upper part of the profile was described as follows: 0 to 5 cm, partially decomposed litter of pine needles; 5 to 35 cm, loose loamy sand with bleached grains; 35 to 40 cm thin iron stained loamy sand; 45 cm plus, stony sand

SITE GROUP: G

INVESTIGATOR: W J Walley
Dept. of Civil Engineering, University of Aston Birmingham

OBJECTIVES

This data set was recorded by a student working under Mr Walley on an investigation of the aerial variability of soil moisture.

OPERATIONAL DETAILS

Frequency and period of readings: Almost weekly at one site G1, from April to December 1976. Monthly to weekly (more frequent during summer) at all sites, during 1977 and 1978.
Reading depths: 10 cm intervals to 150 cm maximum at all sites.
Calibration: A calibration for the data had been prepared but was not available.

SITE DESCRIPTIONS

At each site five access tubes were installed in a cross formation 4 m apart from one another. For the purpose of the databank, the mean of each group of replicates was included rather than the individual datasets. When the access tubes were installed a record of the texture of the cores taken out was made. This has enabled tentative suggestions as to which soil series the sites were located on to be made.

SITE: G1

Grid Ref: SJ921114 *Elevation:* 95 m
Soil: Gleyed brown earth (Clifton) *PM Texture:* Loamy drift
Landuse: Mown grass

The site was positioned adjacent to the meteorological station at the Staffordshire Farm Institute, Rodbaston. It was on a gentle (about 5°) east facing slope just below the crest of a low rise. Originally grazed permanent pasture, the site had been enclosed and was mown during the summer months. The site was well exposed.

Soil: The soil was described as having a sandy loam 0 to 60 cm horizon overlying a 40 cm deep sandy clay layer above a sandy clay loam textured material. The site's topography suggested that it was on till, and so the soil is probably of the Clifton or Salwick series of reddish brown soils derived from Triassic till; this drift is inclined to have sand and clay lenses (Jones 1975).

SITE: G2

Grid Ref: SJ902146 *Elevation:* 90 m
Soil: Brown earth (Newport) *PM Texture:* Sands
Landuse: Permanent pasture

Located in a field of permanent pasture on Preston Vale farm, the trees and hedge more than 30 m distant to the north west will have afforded little shelter to this site. The field surface is flat and approximately 3 m above the river flood plain to which there is a break of slope about 60 m to the south of the site.

Soil: Described as having a sandy loam surface horizon (0 to 40 cm) overlying a loamy sand (30 to 80 cm) above a sand layer (80 cm +), the soil seems similar to the Newport series. This series is prevalent on fluvio-glacial deposits in the vicinity and it is probable that the terrace on which the site was located was of similar origin (Jones 1975).

SITE: G3

Grid Ref: SJ939172 *Elevation:* 85 m
Soil: Brown earth (Newport) *PM Texture:* Sands
Landuse: Permanent pasture

SITE GROUP: G (continued)

The access tubes were located in the corner of a slightly sloping field of permanent pasture at Moat House farm. The site was sheltered to the south and west by woodland about 10 m away. The wood also shaded it from the late afternoon sun.

Soil: The surrounding topography and the soil description provided suggested that the site was located on fluvio-glacial gravels and the soil was tentatively assigned to the Newport series (Jones 1975). The texture of the soil had been described as follows: sandy loam, 0 to 60 cm, stony loamy sand, 60 to 120 cm; loamy sand, 120 to 140 cm and clay, 140 cm +

SITE G4

Grid Ref: SO791945 *Elevation:* 95 m
Soil: Brown earth (Newport) *PM Texture:* Sands
Landuse: Mown grass

The site was located within a meteorological station enclosure at Sutton Farm. The permanent grass sward was managed by mowing. The site was level and quite open.

Soil: The soil profile was described as having a 40 cm layer of sandy loam above a loamy sand layer (40 to 100 cm) which overlies more sandy loam textured material (100 cm +). Its sandy nature and the local topography suggest that it is derived from either fluvio-glacial materials or a sandy drift; the soil is therefore probably akin to either the Newport series, or to the Clifton and Salwick series.

SITE GROUP: H

INVESTIGATOR: R Goodhew
Severn Trent Water Authority, Severn Area Unit, Malvern.

OBJECTIVES

This neutron probe work was conducted in the Tern catchment, to the north east of Shrewsbury, as part of investigations concerning the proposed Shropshire groundwater scheme. The data from two sites were incorporated into the databank. At each site a pair of access tubes was used to monitor soil moisture changes. The data from individual access tubes have been retained in that form for different measuring depths were used at each access tube.

OPERATIONAL DETAILS

Frequency and period of readings: The datasets run from January 1973 until July 1979 and comprise readings made at roughly monthly intervals.
Reading depths: At 10 cm intervals from about 10 cm to about 150 cm.
Calibration: A calibration for the probe was prepared by the Water Research Centre, Medmenham. Two equations were used depending on the ratio of the count standard water count R_w listed below

	a	b	
R/R_w >0.29	1.052	-0.108	$MVF = aR/R_w + b$
R/R_w <0.29	0.473	+0.057	

Readings made within 20 cm of the surface were discarded and the moisture content of that layer estimated by the interpolation of the moisture content profile of the soil below.

SITES: H1 and H2

Grid Ref: SJ635311 *Elevation:* 75 m
Soil: Gley (Clifton) *PM Texture:* Loamy drift
Landuse: Mown grass

The site was near the weather station at Ternhill Airport. It was located well away from any buildings just above the level terrace of the Tern river approximately 30m from the break of slope between the terrace and the valley side. The site was in a small fenced enclosure the grass of which was mown quite frequently. Grassland used for grazing sheep surrounded the enclosure.

Soil: The soil at the site has been described as of the Clifton series of surface water gleys developed on drift of Triassic origin (Jones 1975). At the site a thin turf mat overlies sandy loam A and Eg horizons. Some mottling and a few manganiferous concretions occur in the Eg. Typically below this horizon there is one with a higher clay content which due to its low permeability causes the soil above it to be gleyed.

SITES: H3 and H4

Grid Ref: SJ647282 *Elevation:* 75 m
Soil: Gleyed brown earth (Salwick) *PM Texture:* Loamy drift
Landuse: Mown grass

The two access tubes were located in the corner of grounds of the Stoke pumping station near Stoke Heath. This site is open and slopes very gently northward (2 degrees). It was grassed and the grass was mown several times each year.

Soil: The soil was an example of the gleyed brown earths of the Salwick series which occur on drift which is mainly derived from Triassic rocks (Jones 1975). The texture of the upper 45 cm of the profile was sandy loam but below was a clay loam horizon, the characteristic feature of this series. The poor permeability of this horizon causes gleying of the profile.

SITE GROUP: I

INVESTIGATOR: S Richardson
ADAS West Midland Region Office, Wolverhampton

OBJECTIVES

Soil moisture changes have been monitored at several experiments conducted by the ADAS unit. Data from two grass trials are included in the databank.

OPERATIONAL DETAILS

Frequency and period of readings)
Reading depth:) Detailed with individual site descriptions

Calibration: The neutron probe was calibrated at the Field Drainage Experimental Units' laboratory. Separate calibration equations were used for readings made within 20 cm of the surface.

	a	b	
10 cm	0.000784	0.05792	MVF = aR + b
20 cm+	0.00843	-0.00723	

SITE DESCRIPTIONS

SITE: I1

Grid Ref: SJ478248 *Elevation:* 91 m
Soil: Gley (Crewe) *PM Texture:* Clay drift
Landuse: Permanent grass

The site was at Myddle, 12 km north of Shrewsbury. Five access tubes were installed in the control plots of a subsoiling experiment laid out in a level open field. The mean of the readings from the replicate tubes has been incorporated into the data bank.

Frequency and period of readings: The monthly soil moisture measurements commence in February 1978 and continue to the end of 1979.

Reading depths: Readings were made at 10 cm intervals from 10 cm depth to 100 cm.

Soil: The soil is an example of the Crewe series of surface water gleys which occur on boulder clay drift in the West Midlands (Mackney and Burnham 1964). The texture of the surface horizon (10 to 20 cm) at the site is clay loam. Below is a 10 cm deep clay horizon with weak prismatic structures passing to a strongly prismatic - columnar horizon which at 45 cm merges into the blocky clay parent material. All the horizons are only slowly permeable and the clay below has very low permeability. Rooting is restricted to the upper 45 cm.

SITE: I2 and I3

Grid Ref: SP165548 *Elevation:* 45 m
Soil: Gleyed brown earth (Evesham) *PM Texture:* Clay
Landuse: Temporary grass

The grass trial was conducted at Drayton Experimental Husbandry Farm, 3.5 km due west of Stratford-upon-Avon. The site was in a slightly sloping (2^{o}) field which was re-seeded in 1977. Pairs of access tubes were installed in duplicate plots of a series of plots receiving different quantitites of nitrogen fertiliser and various irrigation applications. I2 represents the mean of readings from two tubes in replicate plots receiving nitrogen applications but no irrigation water. I3 represents the mean of readings from replicate control plots; neither water nor nitrogen were applied. The tubes were read at monthly or shorter intervals through out the spring and summer months of 1978 and 1979.

Soil: A stony, clay, ploughed horizon (0 to 24 cm) with moderate blocky structure overlies mottled clay B horizons which have moderately strong angular blocky structures. Below 65 cm rooting is rare in the course, blocky structured, grey clay. The soil is representative of the Evesham series and is developed in Lower Lias clay.

SITE GROUP: J

INVESTIGATOR: Dr R P Scammell
School of Environmental Sciences,
University of East Anglia

OBJECTIVES

An investigation of the relationship between soil moisture and plant growth was conducted on sugar beet and cabbage crops grown on experimental plots at Brooms Barn Experimental Station and at the Norfolk School of Agriculture, Burlingham, respectively (Scammel 1978). The crops were subjected to various irrigation treatments but only data from non-irrigated control plots have been included in the databank.

OPERATIONAL DETAILS

Frequency and period of readings: Approximately weekly during the growing seasons of the sugar beet and cabbage crops, ie June to October in 1975 and May to October in 1976, respectively.

Reading depths: At 10 cm intervals to 100 cm for the cabbage crop, and to 130 cm for the sugar beet.

Calibration: Field calibrations were conducted at both sites but they were found to be very similar and so were combined as listed below. A separate calibration was prepared for the 10 cm readings.

	a	b	
10 cm	0.000364	0.1415	MVF = aR + b
20 cm +	0.000615	0.0017	

SITE DESCRIPTIONS

SITE: J1

Grid Ref: TL752654 *Elevation:* 75 m
Soil: Gleyed brown earth (Ashley or Moulton) *PM Texture:* Loamy drift
Landuse: Sugar beet crop (Experimental plots)

In 1975 sugar beet was cultivated on experimental plots which were located in Hackthorn Field at Brooms Barn Experimental Station, at Higham in Suffolk near Bury St Edmunds. There was a slight slope across the plots (<5°) to the north-east. Four access tubes were installed in the control plot; the mean of the four sets of data has been included in the databank.

Soil: The soil of the plots graded from an example of the Ashley series at the eastern end to the Moulton series at the West end, ie from a sandy clay loam over chalky boulder clay to a sandy loam over a sandy and loamy chalky drift. Both soils are brown earths but the Ashley shows evidence of gleying due to its more impervious parent material (Hodge and Seale 1966). The less well drained Ashley soil was more predominant.

SITE: J2

Grid Ref: TG368102 *Elevation:* 15 m
Soil: Gleyed brown earth (Wickmere) *PM Texture:* Loamy drift
Landuse: Cabbage crop (Experimental plots)

A cabbage irrigation trial was set up at the Norfolk School of Horticulture, Burlingham, east of Norwich, and included a control plot with three access tubes. The mean of the data from these three are included in the databank. The plots were on a level, open site.

Soil: The soil was an example of the Wickmere series (Scammell 1978) and comprised a sandy loam plough layer above a narrow organic horizon (12 to 14 cm) containing decomposing straw which overlay a weakly structured horizon of loam texture. The is a gleyed brown earth characteristically formed on loamy drift over-lying the non-calcareous sandy loam to sandy clay of the Norwich Brick-earth. The gleying is due to the influence of the regional water table (Corbett and Tatler 1974).

SITE GROUP: K

INVESTIGATOR: D A Stone
National Vegetable Research Station, Wellesbourne, Warwickshire

OBJECTIVES

Several experiments have been conducted at the Research Station to compare the soil moisture regimes of several vegetable crops under various cultivation techniques and to investigate the moisture regime of broad beans in particular, for modelling purposes. (Rowse and Stone 1978).

OPERATIONAL DETAILS

Frequency and period of readings: Weekly or shorter intervals throughout the growing season of the experimental crops. The records are short, extending over only 2 to 5 months each year.

Reading depths: From 10 cm at 10 cm intervals to a maximum depth of 90 cm on all plots.

Calibration: The plots were all sited on the same soil series therefore one calibration was used for them all. It was remeasured in the field each year. The surface effect was counteracted by using separate calibrations for readings made in the 0 to 15 cm layer, and in some years also in the 15 to 25 and 25 to 45 cm layers, as listed below.

Year	Layer (cm)	a	b
1974	0-15	0.0007	+0.00801)
	15-25	0.00086	-0.0684)
	25-45	0.0006	+0.03228)
	45+	0.00069	-0.02371)
1977	0-15	0.00095	-0.00044)
	15-25	0.00092	-0.02313)
	25+	0.00083	-0.1038)
1978	0-15	0.00087	+0.03624)
	15+	0.00077	+0.02337)

MVF = aR + b

It should be noted that the access tubes used, though of the standard material and size recommended by Bell (1976), were not sealed at the base. Difficulties due to water entering the tubes had only been encountered on one occasion.

SITE DESCRIPTION

SITES: K1, K2, K3, K4, K5, and K6

Grid Ref: SP273567 *Elevation:* 45 m

Soil: Gleyed brown earth (Arrow) *PM Texture:* Sandy terrace drift

Landuse: Vegetable cultivation

The experimental plots were all located on the same soil series, in the Big Ground Field, within the grounds of the National Vegetable Research Station. The station is sited on an extensive flat old river terrace.

Soil: The soils of the NVRS have been described by the Soil Survey (Whitfield 1974). The plots were all on soils of the Arrow Series of gleyed brown earths developed in coarse loamy terrace drift. The predominant texture of the relatively deep profiles is sandy loam. The soils are therefore freely drained but the presence of a high ground water table causes mottling and the developmentof manganiferous concretions in the B horizon. During the period of moisture measurement the water table only once rose to 1 m depth.

Crops: Different crops were grown on the individual plots as listed below. Replicate tubes were always used in the control plots; the data included in the databank represents the mean of these replicates.

SITE GROUP: K (continued)

Tube	Crop/Year	Sown	50% Emergence	Max. ground cover	Harvest	No of replicates
K1	B. Bean 1974	9 April	5 May	3 July	28 August	4
K2	B. Bean 1977	5 May	24 May	20 July	1 August	4
K3	B. Bean 1978	11 May	25 May	14 July	11 August	6
K4	Cabbage 1978	Transplanted 15 May	-	10 July	27 July	6
K5	Leek 1978	7 April	13 May	4 September	11 October	6
K6	Red beet 1978	18 May	5 June	31 July	21 August	6

SITE GROUP: L

INVESTIGATOR: W A D Whitfield
Soil Survey at National Vegetable Research Station, Wellesbourne

OBJECTIVES

The work was conducted to provide information about the soil moisture regime of the Wick soil series under permanent pasture and potato crops.

OPERATIONAL DETAILS

Frequency and period of readings: Weekly throughout 1977 and 1978
Reading depths: 10 cm intervals to a maximum depth of 90 cm.
Calibration: A field calibration has been prepared for the Wick series at Wellesbourne as given below. Separate calibrations were established for readings at both the 10 and 20 cm depths.

	a	b	
10 cm	0.169	0.115	$MVF = aR/_{Rw} + b$
20 cm	0.599	-0.03	
30 cm +	0.529	-0.019	

SITE DESCRIPTIONS

SITES L1 and L2

Grid Ref: SP274571
Elevation: 45 m
Soil: Brown earth (Wick)
PM Texture: Stony sandy terrace drift
Landuse: Grass and potato plots

The access tubes were installed in plots in the corner of the Gravel Pits field at the National Vegetable Research Station. The field, located on a flat river terrace, is level but the sites will have been somewhat sheltered from southerly winds by the buildings of the research station. Three replicate tubes were installed in each plot; the means of the readings for these tubes were incorporated in the databank.

Soil: The soil was mapped by Whitfield (1974) as an example of the stony phase of the Wick series, ie a stony brown earth. Characteristically stones comprise more than 5 per cent by volume of the freely drained profile which has a sandy loam surface horizon (0 - 40 cm) overlying a sandy loam to loamy textured, deep, B horizon (40 to 100 cm).

Crops: Three access tubes were located in an area of long term grass derived originally from a sown ley. The site (L1) was therefore representative of a permanent pasture but cut rather than grazed. At site L2 the potatoes were hand cultivated and ridged. The three access tubes were located halfway between the base and the crest of the ridges.

SITE GROUP: M

INVESTIGATOR: Dr H Wheater
Department of Civil Engineering,
Imperial College, London, and Severn
Trent Water Authority, Severn Area Unit

OBJECTIVES

The sites were installed and monitored as part of the Gloucester Surface Water Study organised by the Severn Trent Water Authority with the Water Research Centre. Part of study has been reported in Wheater (1977).

OPERATIONAL DETAILS

Frequency and period of readings: Approximately monthly commencing between July and December 1973 and continuing until September 1977. There is a period from May to October in 1975 for which no readings are available.

Reading depths: Readings were made at 10 cm intervals to about 150 cm maximum depth. The actual reading depths vary from tube to tube but the uppermost were at approximately 10 cm.

Calibration: A field calibration was conducted and was found to give results very similar to the Institute of Hydrology calibrations which were subsequently adopted (Wheater 1977). A method similar to that described by Cole and Green (1966) for modifying surface readings was used to derive calibrations for the surface readings at each site as listed below.

	a	b
M1	0.657	0.210
M2	0.790	0.046
M3	0.524	0.195
M4	1.140	0.145
M5	1.170	0.078
M6	0.711	0.209

$$MVF = aR/_{Rw} + b$$

SITE DESCRIPTIONS

Two access tubes were located at each site but due to the differing measurement depths the results have not been combined. Five of the sites were located along a 4.5 km north west - south east transect between Hardwicke and Harescombe, approximately 7 km to the south of Gloucester. The remaining site (M6) was 2 km north of Gloucester at Longford. All were grassed.

SITE: M1

Grid Ref: SO791126 *Elevation:* 15 m
Soil: Gleyed brown earth (Podimore) *PM Texture:* Clay drift
Landuse: Permanent pasture

This site was located west of Hardwicke close to the Gloucester and Sharpness Canal in a field used for permanent pasture which has been drained. The field is flat and open.

Soil: The soil at the site belonged to the Podimore series of gleyed brown earths developed in drift overlying clay (Cope 1973). The series is characterised by a clay or clay loam A horizon above a similarly textured, mottled B horizon and a more mottled clay C. The clayey parent material causes the soil to be imperfectly drained.

SITE: M2

Grid Ref: SO807119 *Elevation:* 25 m
Soil: Gleyed brown earth (Isle Abbots) *PM Texture:* Loamy drift over clay
Landuse: Permanent pasture

Located in a flat field west of Colethrop Farm but adjacent to some sandpits this site was very open. The field was used for pasture and to produce hay crops in the early summer, it was reseeded in 1976.

SITE GROUP: M (continued)

Soil: The soil was of the Isle Abbots series, a gleyed brown earth of sandy loam texture developed on river terrace deposits. The soil is gleyed because the freely draining profile is underlain by impermeable clays above which is perched a fluctuating groundwater table (Cope 1973).

SITE: M3
Grid Ref: SO813117 *Elevation:* 25 m
Soil: Gleyed brown earth (Podimore) *PM Texture:* Clay drift
Landuse: Pasture

The site was to the west of Colethrop Farm in a field of recently established grass used for grazing. The field was level and open

Soil: The soil was of the Podimore series described for M1, but had not been drained.

SITE: M4
Grid Ref: SO824108 *Elevation:* 50 m
Soil: Gleyed brown earth (Podimore) *PM Texture:* Clay drift
Landuse: Permanent pasture

This site was located to the west of Colethrop on Cross Farm in a small grassed enclosure within a field of permanent pasture. The grass of the enclosure was cut periodically. The site was flat and open.

Soil: The soil was also of the Podimore series of gleyed brown earths described for M1.

SITE: M5
Grid Ref: SO830103 *Elevation:* 76 m
Soil: Gley (Longload) *PM Texture:* Loam
Landuse: Permanent grass

The eastern most of the five sites this one was located at Hayes Farm at the base of the Cotswold scarp. The site sloped gently (3^{o}) to the north-west but rising to the south of it was a steeper (13^{o}) slope. It was located in a small enclosure with a crop of permanent grass.

Soil: The soil was an example of the Longload series of surface water gleys described by Avery (1955). These are soils of silty texture developed on silty mudstones of the Lower, Middle and Upper lias. The poor drainage of the profile is due to the impervious nature of this substratum.

SITE: M6
Grid Ref: SO846209 *Elevation:* 15 m
Soil: Gley (Butleigh) *PM Texture:* Clayey alluvium
Landuse: Mown grass

This site was located in the grounds of the waterworks near Longford. The site was flat and open and cropped with grass which was mown frequently.

Soil: The clayey soil of the site may have been disturbed. However adjacent to the waterworks the soils are mapped as the Butleigh series of gleyed brown calcareous alluvial soils (Cope 1973). These are developed on clayey alluvium derived from Jurassic rocks principally, and are imperfectly drained due to impermeability. of the lower horizons; they are also subject to high groundwater levels in winter.

SITE GROUP: N

INVESTIGATOR: G Wadsworth
ADAS South Western Region, Bristol

OBJECTIVES

The soils unit of ADAS based at Bristol has owned a neutron probe since 1977 and used it to monitor soil moisture changes both in association with specific field experiments and to investigate differences in the soil moisture regimes of local soil series. The individual projects are outlined very briefly with the site descriptions.

OPERATIONAL DETAILS

Frequency and period of readings:)
Reading depths:) listed below with corresponding site details

Calibration: When the probe was bought it was sent to the field Drainage Experimental Unit for calibration. In the course of the laboratory calibration two separate calibrations appropriate for readings at 10 cm and 20 cm depth in the soil profile were determined.

	a	b	
10 cm	0.000839	-0.0292	
20 cm	0.000638	-0.0227	MVF = aR + b
30 cm +	0.000630	-0.0176	

SITE DESCRIPTIONS

SITE: N1

Grid Ref: ST269404 *Elevation:* 15 m
Soil: Gleyed brown earth *PM Texture:* Loamy drift
Landuse: Grass

A single tube was installed as a reference for a grass trial and monitored on a rather irregular basis for 9 months during 1978, at a site known as Cannington to the northwest of Cannington village. It was flat and open being located above the alluvial flood plain of the River Parret, about 10 km from its confluence with the Severn Estuary.

Soil: The soil was a fairly deep permeable, stoneless silt loam of either the Taunton or Longford series of gleyed brown earths (Avery 1955). The former occurs on drift of mixed origin but with some Keuper material; the latter occurs on terrace gravels underlain by Keuper marl. Both series exhibit gleying in their lower horizons due to the fluctuating groundwater table.

SITES: N2, N3, N4, N5, N6, N7, N8 and N9

In 1977 a network of 8 access tubes was installed in the Newent area of Gloucestershire to permit study of soil moisture changes in several soil series. All the sites were grassed.

Frequency and period of readings: Readings were made at approximately fortnightly intervals from May until mid November in 1977 and from March 1978 until February 1979.

Reading depths: Every 10 cm from 10 cm to 90 cm depth.

SITE: N2

Grid Ref: SO777297 *Elevation:* 30 m
Soil: Gleyed brown earth (Whimple) *PM Texture:* Loamy drift
Landuse: Permanent pasture

The site was located towards the corner of a large field. The field slopes eastwards to a stream about 200 m away.

SITE GROUP: N (continued)

Soil: The soil is an example of the Whimple series of gleyed brown earths developed in drift on Keuper Marl (Cope 1973). A silty loam A horizon (0-25 cm) overlay a silt loam horizon (25-60 cm) above a sandy clay loam subsoil (60 to 90 cm).

SITE: N3

Grid Ref: SO791287 *Elevation:* 22 m
Soil: Gleyed brown earth (Whimple) *PM Texture:* Loamy drift
Landuse: Permanent pasture

The location of the site was in a level area of an otherwise rather undulating landscape, in a field at Snigs End Farm. It may have been sheltered to some extent by the buildings and trees which surround the field on all but its west side.

Soil: Another example of the Whimple series very similar to that at site number N2 but for a silty clay loam textured horizon below 60 cm depth.

SITE: N4

Grid Ref: SO792283 *Elevation:* 25 m
Soil: Gleyed brown earth (Worcester) *PM Texture:* Clayey (Keuper Marl)
Landuse: Permanent pasture

The access tube was installed in a field to the west of Snigs End. There is a gentle westward slope across the field. Buildings to the north and east may afford some shelter but are probably too distant.

Soil: Chosen as an example of the Worcester series the soil was a gleyed brown earth of predomimantly clayey texture developed on Keuper Marl (Cope 1973). 30 cm of silt loam overlay material of silty clay texture which extended to at least 90 cm depth. The gleying characteristic of this series is due to the poorly draining parent material.

SITE: N5

Grid Ref: SO744231 *Elevation:* 20 m
Soil: Gleyed brown earth (Worcester) *PM Texture:* Clayey (Keuper Marl)
Landuse: Permanent pasture

Located on Pounds farm just south of Kents Green the site was described as open with a gentle southward slope.

Soil: This site was chosen as a second example of the Worcester series of gleyed brown earths described above. The surface horizon (0 to 30 cm) was silt loam textured and overlay 90 cm of silty clay.

SITE: N6

Grid Ref: SO789214 *Elevation:* 15 m
Soil: Gley (Compton) *PM Texture:* Clayey alluvium
Landuse: Permanent pasture

The site was located on the flood plain alluvium of the river Leadon about 2 km from Maisiemore village. It was level and open.

Soil: The soil was an example of the Compton series of non-calcareous groundwater gley soils developed on alluvium which is derived principally from Triassic rocks (Cope 1973). An organic silty clay loam of 10 cm depth overlay a silty clay loam horizon (10 to 30 cm) above a silty clay (30 to 90 cm). The profile is effected by variations in the local groundwater table and is very poorly drained.

SITE: N7

Grid Ref: SO740232 *Elevation:* 15 m
Soil: Gley (Compton) *PM Texture:* Clayey alluvium
Landuse: Permanent pasture

SITE GROUP: N (continued)

Situated approximately half a kilometre west of site N5, this **site** was chosen as another example of a flood plain soil. It was sited on the flood plain of a small stream to the north of Taynton Court Farm. The site was flat and open although river bluffs to the east and west of it might have provided some shelter.

Soil: The soil was an example of the Compton Series of groundwater gleys described for site N6. However the surface horizon was not very organic. The textural horizonation was as follows: 0 to 20 cm, silt loam; 20 to 30 cm silty clay loam; 30 to 90 cm, silty clay.

SITE: N8

Grid Ref: SO724218 *Elevation:* 45 m
Soil: Brown earth (North Newton) *PM Texture:* Loamy marl
Landuse: Permanent pasture

The access tube was located in a small field having a few scattered trees on a farm west of Taynton. The ground sloped south-eastward and the aspect was in this direction also.

Soil: The soil was an example of the North Newton Series, first described by Findlay (1965). This series, very similar to the Bromsgrove, comprises well drained loamy brown earths having textural B horizons. The parent material was Triassic sandstones and marls. The profile was described texturally as follows: 0 to 30 cm, fine sandy loam; 30 to 60 cm, loamy fine sand; 60 to 80 cm sandy clay loam; 80 to 90 cm, loamy fine sand

SITE: N9

Grid Ref: SO723218 *Elevation:* 60 m
Soil: Brown earth (Bromsgrove) *PM Texture:* Sandstone and marl
Landuse: Permanent pasture

The site was in an eastward sloping field quite near to the crest of one of the hills flanking the forest of Dean, and adjacent to site N8. Woodland on the hill crest probably shelters the site to the west.

Soil: The soil belongs to the Bromsgrove series of freely drained brown earths developed upon Triassic sandstones and marls (Hollis and Hodgson 1974). The profile comprised a 40 cm deep layer of fine sandy loam texture over loamy fine sand.

SITE: N10

Grid Ref: ST695981 *Elevation:* 15 m
Soil: Gley (Speller) *PM Texture:* Clay
Landuse: Grass

A mole drainage trial was set up in 1978 on Alkington farm, near the village of Berkeley. The aim of the trial was to assess the influence of moling timing on the success of mole drainage. Four access tubes were installed in four of the control plots and the means of their readings have been included in the databank. The readings cover the period January 1978 to November 1979. From the first half of 1978 they are approximately fortnightly but they are less frequent in 1979, monthly. The reading depths were at 10 cm intervals from 10 to 100 cm.

The trial was conducted in a field to the south east of the farmstead on a level area. The surrounding country is flat and lowlying. There was a wood of small trees between it and the farm and these may have afforded some shelter from north westerly winds.

Soil: The soil was an example of the Speller series of surface water gley soils which were originally described by Mackney and Burnham (1966). They are characterised by the presence of silt loams or silty clay loams overlying strongly

SITE GROUP: N (continued)

mottled silty clays developed on Silurian and Ordovicion mudstone. At Alkington a 30 cm deep silty clay loam horizon overlies a silty clay sub-soil. The poor drainage of the profile is due to the low permeability of the fine textured lower horizons.

SITES: N11, N12, N13 and N14

Grid Ref: SO780225 *Elevation:* 15 m
Soil: Various *PM Texture:* Various
Landuse: Winterwheat crop

Soil moisture changes were monitored during 1979 on a trial investigating the response of winter wheat, grown on four different soil types, to nitrogen applications. The researchers were very fortunate in locating a field in which the four series Whimple, Worcester, Dunnington Heath and Rushwick occurred and so being able to organise a highly controlled experiment. Replicate plots were laid out on each soil type but only one access tube was installed per group of plots.

Frequency and period of readings: The tubes were read at rather irregular time intervals from March 1979 until February 1980.
Reading depths: 10 cm intervals between 10 and 90 cm.

The field was on Murrell's End Farm near Hartpury which is located in an area of gently undulating but open landscape. The four groups of plots were laid out in two pairs less than 100 m apart on the opposing slopes of a slight north-south undulation in the field. The Whimple and Worcester series (N1 and N2) were to the west side and the Dunnington Heath and Rushwick examples (N3 and N4) were to the east. The whole field was sown to winter wheat in both 1979 and 1980.

Soil: N11: This access tube was in one of the eastward sloping plots on the Whimple series. The Whimple series comprises gleyed brown earths developed in drift on Keuper Marl (Cope 1973) and are imperfectly drained due to the poor permeability of the subsoil.

N12: The Worcester series plots also sloped gently eastward. This series is similar to the Whimple but the gleyed brown earth soils are predominantly clayey textured and the soils occur on the Keuper Marl (Cope 1973). The poor permeability of the lower soil horizons causes their imperfect drainage.

N13: This group of plots were located so as to represent the Dunnington Heath series of gleyed brown earths which are developed on thin loamy drift over Keuper Marl (Thomasson 1971). Course loamy horizons (sandy loam, loam or sandy clay loam) overlie clay or silty clay to which there is an abrupt boundary within 100 cm from the soil surface. Iron enrichment may occur in the layer above this boundary. The slightly imperfect drainage of the lower part of the profile is due to the underlying Keuper Marl. At this site the texture of the profile was described as follows: 0 to 60 cm, very fine sandy loam; 60 to 100 cm; silty clay loam.

N14: The plots representing the Rushwick series were located downslope of the Dunnington Heath examples and were almost level. The soil at the site is described as 80 cm of fine sandy loam overlying a sandy clay loam with faint mottling. The Rushwick series occurs on loamy reddish river terrace deposits and is included in the Peaton Series of brown earth map-unit which has recently been mapped and described (Sheet no. SO85/95, Worcester and Upton Snodbury; in preparation)

SITE: N15

Grid Ref: ST577783 *Elevation:* 70 m
Soil: Brown earth *PM Texture:* Loam
Landuse: Mown grass

This site is located in the grounds of the Bristol Regional Office of MAFF.

It was installed to allow a comparison between the moisture regime under grass and that of arable crops eg. potatoes and barley, grown on small adjacent plots. Only the data from the grass crop are included here. Soil moisture changes have been monitored since March 1977 and the record in the databank continues until October 1979. There is a 4 month gap at the beginning of 1979 but otherwise the readings are generally weekly. Readings were made at 10 cm intervals from 10 to 70 cm.

The access tube was installed in the area of mown grass surrounding the meteorological station located to the north-east end of the main building. It is not more than 15 m from the building which almost certainly shelters it to some extent. The ground is quite level. The soil has been described as a well drained fine sandy loam over Lias clay.

SITE: N16

Grid Ref: ST733740 *Elevation:* 105 m
Soil: Gley (Longload) *PM Texture:* Clay
Landuse: Grass ley

A pair of access tubes were installed adjacent to a grass slurry trial to provide background information on the soil moisture changes during 1979. Readings were made approximately every two weeks from April till the end of the year at 10 cm depth intervals from 10 to 90 cm. The mean of the two sets of readings has been included in the databank. The trial was laid out in a west facing field with a gentle slope at the foot of the Cotswold scarp. The grass was a Timothy/Meadow fescue ley sown in 1977. It was cut on 11 June and 17 September in 1979.

Soil: The site was located in an area on the Longload series of surface water gleys developed on mudstone of the Middle Lias. The profile comprised 50 cm of silt loam to silty clay loam textured material which was mottled in the lower part; this overlay a more mottled silty clay. This series has been described in detail by Avery (1955).

SITE GROUP: O

INVESTIGATOR: Microclimatology Section
Long Ashton Research Station, Bristol

OBJECTIVES

An experiment was conducted during 1974 and 1975 in order to establish the differences in apple yield from bush apple tree plots subjected to different conditions of water stress. Only those data recorded for the control trees are included in the databank.

OPERATIONAL DETAILS

Frequency and period of readings: At about 10 day intervals from June to October in 1974, and approximately weekly from April till September in 1975.
Reading depths: The first reading depth was at 20 cm; below this readings were made at 15 cm intervals down to a maximum depth of 140 cm.
Calibration: A field calibration was prepared. A surface calibration was not necessary as readings were not made in the surface 20 cm layer. Water counts were made weekly.

	a	b	
20 cm	0.855	-0.0295	$MVF = aR/_{Rw} + b$

SITE DESCRIPTION

SITE: 01
Grid Ref: ST534704 *Elevation:* 30 m
Soil: Brown earth (Tickenham) *PM Texture:* Loamy drift
Landuse: Orchard

The experiment was carried out on an established orchard of bush apple trees (planted in 1965), on plot 21b in the grounds of the research station. The orchard has since been grubbed. The plot slopes gently (5^{o}) to the South and is at the base of a long, steeper hillslope.

Crop: The trees were planted 2 m apart in rows about 4.5 m apart. A 1.5 m strip of bare soil was maintained along the length of the tree rows by using herbicides. Between the rows was a grass alleyway. Eight access tubes were installed at the edge of the alleyway, equidistant from the two nearest trees, in the control groups of trees. A mean set of data for the orchard was derived from the 8 sets of data.

Soil: The soils of the research station have been described by Cope (1969). Those of plot 21b belong to the Tickenham series of well drained brown earths developed on drift overlying the Keuper Marl or Dolomitic conglomerate. Typically a surface loam horizon overlies a better structured loam above a clay loam of firm consistency. On plot 21b it was found that this latter horizon limited root development below 90 cm. However it was also observed in the course of installing the access tubes on this experiment that the soil was quite variable.

SITE GROUP: P

INVESTIGATOR: Dr G Stinchcombe
Pomology Section, Long Ashton Research Station, Bristol

OBJECTIVES

Soil moisture changes were monitored as part of a trial carried out in a bush apple tree orchard at Long Ashton. Its aim was to demonstrate the effects of using different types of ground cover on apple production. Only two treatments, which are comparable with commercial practice, were considered for the purpose of the databank ie strips of bare soil under the trees with grass alleyways between, and secondly, a total herbicide treatment.

OPERATIONAL DETAILS

Frequency and period of readings: Approximately weekly during the period May to the end of August, or September, in 1976, 1977 and 1978.
Reading depths: From 20 cm depth to 90 cm at 10 cm intervals, and additionally at 95 cm.
Calibration: A field calibration was conducted in 1976 giving the following equation:

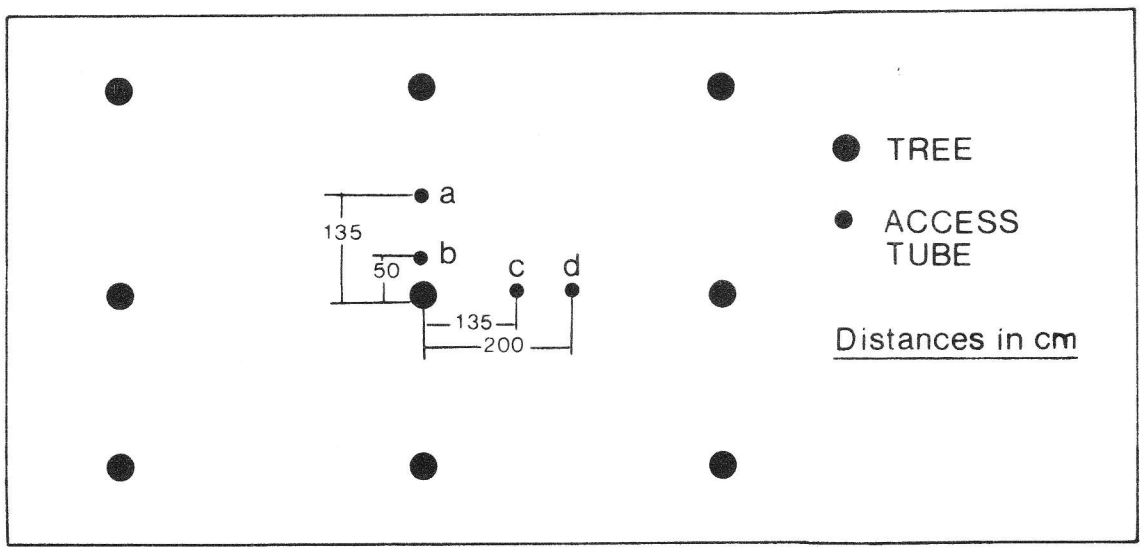
$$MVF = 0.81\ R/_{Rw} + 0.02$$

No surface calibration was necessary as no readings were made within the top 20 cm.

SITES: P1, P2, P3, P4, P5, P6, P7 and P8

Grid Ref: ST535694 *Elevation:* 30 m
Soil: Brown earth (Greinton) *PM Texture:* Clayey (marls and sandstone)
Landuse: Orchard

The trial was conducted on Plot 7b in the grounds of Long Ashton Research Station near Bristol. The orchard comprised a variety of bush apple trees planted at 2.7m intervals in rows 4 m apart. The grass alleyway, when present, was 3 m wide. There is a gentle (< 5°) northward slope along the rows for the plot is located near the crest of a steeper slope. Sets of 3 access tubes were installed adjacent to individual trees as shown in the plan diagram. In 1978 an additional access tube was installed midway between the trees in adjacent rows, ie 2 m from each tree.



SITE GROUP: P (continued)

This installation was replicated on four trees in each treatment. In order to provide an areal estimate of the soil moisture changes within the orchard, a weighted soil profile moisture content value for the area associated with each tree was derived on the following basis. The data from the separate access tubes a, b, c (was combined in the proportions a 0.25, b 0.3, c 0.38), (and in 1978 a 0.16, b 0.21, c 0.38 and d 0.25) to provide a weighted soil moisture content value for the orchard. P1, P2, P3 and P4 represent the conventional orchard; p5, p6, p7 and P8 represent the fully herbicided orchard.

Soil: The soil on plot 7b is an imperfectly drained brown earth of the Greinton series and has been mapped (Cope 1969). The Greinton series occurs on the clay loams and clays of the interbedded Triassic Marls and sandstones and colluvium derived therefrom. The soil is of loam texture becoming clay loam or clay at a depth of 80 to 110 cm. The presence of manganiferous concretions and occasionally mottling, in the lower horizon, indicates that it is not entirely freely draining.

SITE GROUP: Q

INVESTIGATOR: Dr R White
Dept. of Agricultural Science, University of Oxford

OBJECTIVES

Nine access tubes were installed on the Oxford University Farm, to the west of Oxford, as part of a study of the Wytham catchment. The Wytham stream flows north-eastward from Wytham Hill down on to the Thames flood plain and has a small elongated catchment not more than 500 m wide but 1.5 km in length. The access tubes are installed to either side of the stream in the lower two-thirds of the catchment.

OPERATIONAL DETAILS

Frequency and period of readings: Weekly from May 1978 onwards. However the run of data in the databank halts at the end of December 1979.

Reading depths: 10 cm intervals from 10 cm to 90 cm, and from that depth at 20 cm intervals to 190 cm.

Calibration: The Institute of Hydrology calibrations appropriate to the soils textures were used. A separate calibration was used for the 10 cm readings:

$$MVF = 0.54\ R/_{Rw} + 0.236$$

SITE DETAILS

SITES: Q1, Q2, Q3, Q4, Q5 and Q6

Grid Ref: SP470087 *Elevation:* 70 to 100 m
Soil: Gleyed brown earth (Evesham) *Texture:* Clay
Landuse: Arable and permanent grassland

SITE: Q1 and Q2 were installed in an arable field near the base of the hillslope. The field slopes slightly eastwards. It has been drained and access tube Q1 was next to a drain whereas Q2 was between drains. Winter wheat was grown there in both 1978 and 1979.

In the two fields to the south of this were located sites Q3, Q4 and Q5. These two fields are very similar to the first but are used as permanent pasture. Sites Q4 and Q5 are on slopes of about 5°.

Sites Q6 and Q7 were in the field upslope from tubes Q1 and Q2; it slopes at about 8° and in 1978 and 1979 was cropped with spring barley.

Soil: The soil comprises silty clay and silty clay loam surface horizons overlying a gleyed clay horizon which merges into the underlying Oxford clay parent material. It is an example of the Evesham Series of gleyed brown earths developed on non-calcareous clays (Avery 1964). During dry summers, or if drained, the clay shrinks and cracks and the drainage may be much improved. When installing the access tubes, it was noted that the surface horizon at site Q5 was of sandy clay loam texture and at Q6 there is a gravelly horizon at about 50 cm depth.

SITES: Q8 and Q9

Grid Ref: SP465087 *Elevation:* 110 m
Soil: Gleyed brown earth (Kingston) *PM Texture:* Sandy
Landuse: Mixed woodland

Both sites are within the woodland that forms the upper part of the Wytham catchment. They are about 100 m apart on a straight slope of about 5°.

Soil: This is a calcareous variant of the Kinston series described by Jarvis (1973). The profiles have a sandy clay loam or sandy clay horizon over loamy sand. Between 80 and 180 cm is a distinct clay lense. Kingston series soils tend to be imperfectly drained as a consequence of water perching on the textural B horizon.

SITE GROUP: R

INVESTIGATOR: Dr M Goss
Letcombe Laboratory, Wantage

OBJECTIVES

The soil moisture data was collected during 1977 in the course of a field experiment set up to compare conventional ploughing and direct drilling methods at a site known as Compton Beauchamp, near the Letcombe Laboratory.

OPERATIONAL DETAILS

Frequency and period of readings: Twice per week from February until 1 September 1977, and less frequently earlier in the year.

Reading depths: At 5 cm intervals from 5 to 60 cm depth then at 10 cm intervals to 210 cm depth. However only readings made at 10 cm intervals were included in the databank.

Calibration: A field calibration was prepared. With readings made at depths 20 cm and less, separate calibration factors were used as shown below.

	a	b
10 cm	1.0183	0.0641
20 cm	0.9294	0.0288
30 cm +	1.000	-0.10

$$MVF = a\frac{R}{Rw} + b$$

SITE DESCRIPTION

SITES: R1 and R2

Grid Ref: SU273876
Elevation: 91 m
Soil: Gley (Denchworth)
PM Texture: Clay
Landuse: winter oat crop

The experimental plots were laid out in an almost level field. Access tubes were installed in most of the plots but only the data from those in two pairs of replicate plots have been included in the databank. These were selected as they were read most frequently. R1 represents the mean of two tubes in replicate direct drilled plots; R2 represents two plots which have been ploughed. The results of the work at Compton Beauchamp during 1977 are described in the Letcombe Laboratory Annual Report for that year.

Soil: The soil is a Denchworth series surface water gley developed in Oxford clay. This series has been described by Jarvis (1973).

SITE GROUP: S

INVESTIGATOR: M A Gowman
ICI, Jealott's Hill

OBJECTIVES

The data was recorded in 1979 as part of an experiment to investigate the effects of different tillage systems (conventional ploughing, sub-soiling and direct drilling) on soil moisture status and the yield of cereal crops growing on clay soils.

OPERATIONAL DETAILS

Frequency and period: Readings were made at irregular intervals during early 1979 until May when they were made approximately fortnightly until the crops were harvested in August.

Reading depths: The upper reading depth was 20 cm; below this they were made at 10 cm intervals to a maximum depth of 160 cm.

Calibration: The Institute of Hydrology's calibration for clay soils was used. No surface calibration was used.

SITE DESCRIPTION

The work was conducted on experimentalplots laid out on Wisborough Green in West Sussex (T2 050277). Winter wheat was grown on the polts. They were quite level but located at a crest of a westward slope to a stream. The aspect is open and the altitude approximately 30m.

Tube S1 was in a plot which was ploughed conventionally in 1978. S represents a plot which was subsoiled in 1977 and ploughed in 1979 before the winter wheat crop was planted.

Soil: The soil is a surface water gley of the Hildenborough series, developed on driftover Wealden clay (Green and Fordham 1973). The texture of the surface horizon is silt loam and this overlies clay B and C horizons. The base of the profile is seasonally waterlogged due to the impermeable underlying clay. Deep sub-surface cracks develop during dry summers.

SITE DESCRIPTION

SITES: S1 and S2

Grid Ref: TQ050277 *Elevation:* 30 m

Soil: Surface water gley (Hildenborough) *PM Texture:* Clay

Landuse: Winter wheat crop

The work was conducted on experimental plots laid out in field F11 at Naldrett's Court Farm near Wisborough Green in West Sussex. Winter wheat was grown on the plots which were quite level but located at the crest of a westward slope to a stream. The aspect was open.

Tube S1 was in a plot which was ploughed conventionally in 1978. S2 represents a plot which was subsoiled in 1977 and ploughed in 1979 before the winter wheat crop was planted.

Soil: The soil is a surface water gley of the Hildenborough series, developed on drift over Wealden clay (Green and Fordham 1973). The texture of the surface horizon is silt loam and this overlies clay B and C horizons. The base of the profile is seasonally waterlogged due to the impermeable underlying clay. Deep sub-surface cracks develop during dry summers.

SITE GROUP: T

INVESTIGATOR: Institute of Hydrology

Neutron probe work has been carried out by the Institute of Hydrology since 1964. The datasets included in the databank were collected as part of five projects which have been conducted in southern England. The Grendon Underwood and Cam projects were both catchment water balance studies. At Thetford the work concentrated on the measurement of moisture fluxes in unsaturated soil under both grassland and forest. Most recently two projects have investigated moisture and solute fluxes in the unsaturated zone beneath grassland and cereal crops at Fleam Dyke near Cambridge and Bridgets Experimental Husbandry Farm near Winchester.

OPERATIONAL DETAILS

Calibrations: The standard calibrations determined by the Institute for soils of different texture were used with the data from these sites. During both the Grendon Underwood and Cam catchment studies the surface effect was counteracted by placing a tray of soil on the ground surface at the access tubes while making measurements, as described by Bell (1976). At Thetford and Bridgets Farm the shallowest measurements were taken at 20 cm depth. At Fleam Dyke readings were made at 10 cm depth but no corrections were applied for the surface effect.

SITES: T1, T2, T3, T4, T5, T6 and T7

OBJECTIVES

Soil moisture changes were monitored from 1966 to 1970 at seven sites as part of the Grendon Underwood study of a clay catchment. The study catchment is located in the Oxford Clay vale to the south of Buckingham and is drained by the river Ray which flows south westward to meet the Cherwell north of Oxford. Prior to 1969 Danbridge and EAL probes were used and therefore the data for the early part of the study have not been included in the databank.

OPERATIONAL DETAILS

Frequency and period of readings: Approximately weekly from August 1969 until December 1970.

Reading depths: Until February 1970 readings were made at 10 cm intervals from 10 to 50 cm depth and at 25 cm intervals from 50 to 100 cm with a final reading at 150 cm depth. Subsequently below 40 cm, readings were recorded at 20 cm depths intervals to 160 cm. Then from mid-May onwards, the interval was changed to 15 cm.

SITE DESCRIPTIONS

The soils of the catchment were mapped by B W Avery of the soil survey in 1969. Soil descriptions specific to the sites are not available.

SITE: T1

Grid Ref: SP676215 *Elevation:* 68 m

Soil: Gleyed brown earth (Evesham) *Texture:* Clay

Landuse: Mown grass

The access tube was installed within the enclosure of the meteorological station at Grendon-Underwood which is sited about 1 km north of the village. The site is level and open and the grass was frequently mown to maintain a short sward.

Soil: This was an example of the Evesham series of calcareous brown earths developed in Oxford clay. These soils usually have a 15 cm deep clay loam A horizon with a well developed blocky structure. A thin mottled clay B horizon with coarse blocky structure usually merges to a poorly structured clay at about 35 cm. (Jarvis 1973).

SITE GROUP: T (continued)

SITE: T2

Grid Ref: SP683205 *Elevation:* 76 m
Soil: Gleyed brown earth (Evesham) *Texture:* Clay
Landuse: Permanent pasture

The site was in a small field of permanent pasture on Grange farm which is in Grendon Underwood village. The field is level and open to the south and east but the site was within 70 m of buildings to the north side and 100 m to the west side.

Soil: The site was also in an area mapped as Evesham series. (See T1)

SITE: T3

Grid Ref: SP693225 *Elevation:* 76 m
Soil: Gley (Denchworth) *Texture:* Clay
Landuse: Mown grass

This access tube was in an area of rough mown grass bordering the driveway to Prune Farm. The site was level and open.

Soil: The soil is of the Denchworth Series which is similar texturally to the Evesham (see T1) but decalcified and distinctly gleyed. A clay loam to clay textured horizon of 15 to 20 cm depth overlies a gleyed coarse blocky to prismatic structured subsoil. It merges to the clay parent material at between 40 and 80 cm depth. The clay dries out and develops deep cracks during dry summers. These disappear during the winter months and so unless artificially drained or in a sloping situation, the soils are prone to water-logging (Avery 1964).

SITE: T4

Grid Ref: SP709237 *Elevation:* 91 m
Soil: Gley (Denchworth) *Texture:* Clay
Landuse: Grassland

The access tube was located in a small grassed area at the edge of a cultivated field next to an unfenced track. The site was level and very open.

Soil: The soil was also of the Denchworth series of non-calcareous gley clay soils, (see T3).

SITE: T5

Grid Ref: SP707202 *Elevation:* 76 m
Soil: Gley (Rowsham) *Texture:* Clay
Landuse: Permanent pasture

The access tube was sited towards the corner of a field on Knapps Hook farm. The site is level and open.

Soil: The Rowsham series of gleys occurs where the Oxford Clay is overlain by at least 40 cm of loamy or gravelly drift. The soils are therefore friable and of sandy loam to clay loam texture in their surface horizons. However the underlying clay is generally impervious and consequently the soil is imperfectly drained and prone to waterlogging in winter (Avery 1964).

SITE: T6

Grid Ref: SP733217 *Elevation:* 95 m
Soil: Gley (Rowsham) *Texture:* Clay
Landuse: Permanent pasture

Located in a large field to the south-east of Dry Leys farm, this site was almost level, and open. A hay cut was taken from the field each summer.

Soil: The soil was mapped as Rowsham series (See T5)

SITE: T7
Grid Ref: SP717225 *Elevation:* 122 m
Soil: Brown earth (Quainton Hill complex) *PM Texture:* Sand
Landuse: Permanent pasture

The site was in a large field to the north of Finemere Hill House. The field slopes gently (5°) to the north-west. There was a line of trees 70 m upslope to the south of it but this is unlikely to have afforded much shelter to the site.

Soil: The soil at the site is a sandy example of the Quainton Hill Complex of brown earths which occur in this area on Shotover and Portlandian rocks and on head derived principally from these rocks. The soil is fairly well drained and sandy loam in texture with clayey layers (Avery 1964).

SITES: T8, T9, T10, T11, T12, T13 and T14
OBJECTIVES
A network of seven soil moisture measurement sites was installed in the upper Cam catchment (ie above Cambridge) as part of a study of this drift covered chalk catchment. The Cam drains northwards to Cambridge from a chalk upland. At each site a single access tube was installed during the autumn of 1966.
Frequency and period of readings: Measurements using Wallingford type probes were made at each site from March 1970 until April 1972, at monthly intervals.
Reading depths: At 10 cm intervals from 10 to 30 cm and at 15 cm intervals below this depth, to 160 cm.

SITE: T8
Grid Ref: TL488474 *Elevation:* 25 m
Soil: Gley (Rib) *PM Texture:* Clay
Landuse: Permanent pasture

The site was on the alluvial floodplain of the east bank of the river Cam at Whittlesford Bridge, about 40 m from the river. It was a very wet site vegetated by rough grassland and bushes.

Soil: The soil there is an example of the Rib series of calcareous gleys which characterise the clayey alluvial deposits of the region (Thomasson 1969). Characteristically about 30 cm of quite humose clay loam or silty clay loam overlies a deep clay or silty clay.

SITE: T9
Grid Ref: TL502466 *Elevation:* 30m
Soil: Brown calcareous (Swaffham-Prior) *PM Texture:* Loamy chalk drift
Landuse: Permanent pasture

The site was in a large field which is maintained as parkland adjacent to Hinxton Grange. The field is level and small groups of trees are scattered about it but the access tube was located well away from them.

Soil: The soil has been mapped as the Swaffham Prior Association of brown calcareous soils developed in chalky loamy drift overlying solid chalk. The chalk usually occurs within 60 cm of the soil surface (Thomasson 1969).

SITE: T10
Grid Ref: TL422420 *Elevation:* 70 m
Soil: Brown calcareous (Swaffham-Prior) *PM Texture:* Loamy chalk drift
Landuse: Permanent pasture

Located to the north side of Ickleton Old Grange in a field of permanent pasture, the site was open but sloped at about 8° to the south.

Soil: The soil was also mapped as the Swaffham Prior Association (see T9).

SITE: T11

Grid Ref: TL536423 *Elevation:* 110 m
Soil: Gley (Hanslope) *PM Texture:* Clay
Landuse: Permanent pasture

The site was in the parkland to the west of Chesterford Park near Little Walden. It was flat and well away from any of the scattered trees of the park so quite open.

Soil: The soil is an example of the Hanslope series of calcareous gleys described by Thomasson (1969) which dominate the areas of chalky boulder clay in the Cam catchment. A clay loam or clay surface horizon overlies a very stiff clay B horizon. Below this is a zone of gleyed calcareous clay above almost impermeable clay. The impermeable clay is generally present within 80 cm of the surface.

SITE: T12

Grid Ref: TL548313 *Elevation:* 110 m
Soil: Gley (Hanslope) *PM Texture:* Clay
Landuse: Permanent pasture

Situated in a field of permanent pasture in the grounds of Mole Hall, east of Widdington, this site was level and open. The field was cut for hay each summer.
Soil: The soil at this site has also been mapped as Hanslope series (see T11).

SITE: T13

Grid Ref: TL558326 *Elevation:* 91 cm
Soil: Gley (Hanslope) *PM Texture:* Clay
Landuse: Permanent pasture

This site was 2 km to the north-east of T12 in a field across the road from the farmyard of Broxton's farm. The field is on a south-west facing slope of about 5° but is open. It was used to grow hay during the period of the work at the site.
Soil: The soil is also of the Hanslope series (see T11).

SITE: T14

Grid Ref: TL494387 *Elevation:* 100 m
Soil: Gley (Hanslope) *PM Texture:* Clay
Landuse: Permanent pasture

The site was in the middle of a gently south-eastward sloping field (about 5°) adjacent to Howe Hall. There are a few trees growing within the field and in its hedgerow boundary but the access tube was installed in an open area away from their influence.

Soil: This was another example of the calcareous gleys of the Hanslope series (see T11.

SITES: T15, T16 and T17

OBJECTIVES

A major investigation of moisture fluxes in the unsaturated zone of the soil was conducted in Thetford Forest between 1974 and 1976; a detailed account of the work is provided by Cooper (1980). Thetford Forest is located in the Breckland on the Norfolk-Suffolk border. The main block of the forest, where the study was conducted, is between Elveden and Mundford. Three soil moisture measurement sites were installed, two within the forest (T15 and T16) and one at a grass clearing in the forest (T17). The forest is largely comprised of Scots pine and Corsican Pine; the clearing was grassed.

Frequency and period of readings: Readings were made at the main forest site, T15, from the end of January 1974 at monthly intervals till July and then twice per week until the end of 1975. During 1976 fortnightly readings were made at T15. Readings of the groups of tubes at T16 and T17 commenced in January and August 1975 respectively. They were conducted on a weekly basis at T16 and twice weekly at T17 during 1975, and then fortnightly at both sites throughout 1976.
Reading depths: At T15 and T16 the reading depths were at 20 cm, 35 cm, 50 cm and then at 30 cm intervals to 310 cm depth. At the clearing site T17 the reading depths were at 10 cm intervals from 20 cm to 60 cm depth, and then at 20 cm intervals to 300 cm depth.

SITE: T15
Grid Ref: TL805835 *Elevation:* 50 m
Soil: Brown earth (Worlington) *PM Texture:* Sand
Landuse: Coniferous forest plantation

This site was in a gently undulating part of the forest at least 4 km in all directions from the forest edge. There was a 1° slope to the west across the site. A grid of 81 access tubes were installed in a 4 ft (1.2 m) square array. This layout was spaced independantly of that of the tree lines. Only a sample of the access tubes in the grid were read on every reading occasion but all were read once per month. The data from the grid have been simplified by computing the means of readings from groups of access tubes. In Fig. 28 data representing the mean of readings at 4 tubes are presented.

Crop: The trees at the site were Scots Pine which were planted in 1931 and at the time of the experiment had reached a neight of 16 m. There was a dense understorey of bracken.

Soil: The soil has been mapped as Worlington series (Corbett 1973) but Cooper (1980) has described it in more detail. Essentially it is a brown earth type soil developed in sand which overlies chalky drift on the chalk. A 5 to 10 cm deep layer of pine needle litter overlies a sandy layer of varying depth. Its lower boundary, which is generally at about 75 cm, frequently extends down into deep pockets in the chalky drift. There is a shallow horizon with translocated clay below the sand and it directly overlies the chalky drift parent material. This chalky drift is variable in character but generally comprises a mixture of sand and lumps of chalk with many flints. Solid chalk occurs at about 270 cm; the boundary between it and the drift is much more regular than those between the horizons above.

SITE: T16
Grid Ref: TL757936 *Elevation:* 15 m
Soil: Rendzina (Methwold-Newmarket) *PM Texture:* Sand
Landuse: Coniferous forest plantation

About 10 km to the north-west of T15, but still within Thetford forest, a grid of nine access tubes were installed. The grid formed a 3 x 3 array with 1.2 m spacing. In Fig. 21 the profile moisture content values represent the means of the values obtained at 9 access tubes.

Crop: The site was in a stand of Corsican Pine. The trees were about 16 m high. There was an understorey of brambles and nettles.

Soil: The soil in this part of the forest has been mapped as a complex of the Methwold and Newmarket Series which are both shallow sandy calcareous soils occurring on mixed sand and chalk drift. The soil at the site was observed to comprise a sandy surface horizon overlying very chalky sandy drift. The boundary to the underlying solid chalk was at about 170 cm (Cooper 1980)

SITE: T17

Grid Ref: TL800837 *Elevation:* 50 m
Soil: Brown earth (Worlington) *PM Texture:* Sand
Landuse: Grass

The clearing was approximately 1 km west-north-west of T15. It measured 170 by 140 m but was inevitably sheltered to some extent by the forest on all sides. From August 1975, a group of five access tubes were read at this site. The profile moisture contents shown in Fig. 29 represent the mean of those measured at the five individual tubes.

Crop: The grass at the site though cut in previous years was not mown during the period of the experiment

Soil: The soil at this site appeared very similar to that described for site T 15.

SITE: T18

OBJECTIVES

A project is being conducted by J D Cooper on the chalk outcrop east of Cambridge to investigate the behaviour of moisture in the unsaturated zone of the chalk and the implications of this for recharge to the chalk aquifer.

Frequency and period of readings: Twice per week from September 1977 but for a 3 month period in 1978. The readings are continuing.
Reading depths: Every 10 cm from 10 cm to 60 cm then at 20 cm intervals to 300 cm and finally at 330 cm.

SITE: T18

Grid Ref: TL539549 *Elevation:* 30 m
Soil: Brown calcareous (Swaffham-Prior) *PM Texture:* Loamy chalk drift
Landuse: Mown grass

This site is in the grounds of the Fleam Dyke pumping station. The site is flat and open. Two replicate instrumented plots were installed in mown grass approximately 10 m apart. Within each plot there are three access tubes all of more than 3 m depth.

Soil: The soil is an example of the Swaffham-Prior complex of brown calcareous soils developed on chalky drift overlying solid chalk. The series has been described by Thomasson (1969).

SITES: T19, T20, T21, T22

OBJECTIVES

Soil moisture data were recorded in the course of an investigation of the movement of both water and nitrate in the unsaturated zone of the chalk at a site on the Upper Chalk near Winchester in Hampshire, (Wellings and Bell 1980). Both grass and arable plots were considered.

Frequency and period of readings: Twice per week from July 1976 in the main plot (T19). In the arable plots, T20 and T21 the readings were made at the same frequency but for one year from March 1978, and one year from March 1979 respectively.
Reading depths: At 20 cm intervals from 20 cm to 320 cm.

SITES: T19, T20 and T21

Grid Ref: SU517339 *Elevation:* 85 m
Soil: Rendzina (Andover) *PM Texture:* Chalk
Landuse: Mown grass and spring barley (Experimental plots)

The sites were in a field to the south of the office buildings of Bridgets Experimental Husbandry Farm which is situated to the north-east of Winchester. The sites

represent three sets of experimental plots which were located adjacent to one another on a level part of the field. The sites were exposed to wind mainly from the north, west and south.

Crop: T19 and T20 represent two 3 x 3 m grass plots, each with an access tube. To one plot, T20, nitrogen applications in the form of slurry were applied by hand irrigation during the winter months. The application rate was equivalent to 40 cows ha^{-1} $year^{-1}$. The grass was cropped twice a year in May and July. The site T21 was an arable plot on which spring barley undersown with grass was cultivated in 1978. The barley was harvested in the second week of August that year. Three replicate plots of 10 x 30 cm size were instrumented during the winter of 1978 and sown with spring barley and the site T22 therefore has 3 replicate sets of data.

Soil: The soil consists of 20 to 30 cm of silty clay loam above a 150 cm deep layer of fragmented chalk overlying solid chalk. It is an example of the Andover Series of rendzinas (Jarvis 1973).

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The members of the Soil Physics Section have all helped with the work. In particular Mr J P Bell, who supervised the MORECS Soil Moisture Deficit Project, has provided much guidance in the compilation of the databank and of this report. Ms C Bowker and Ms S J Walker both assisted in the organisation of the data bank and in the preparation of the diagrams for this volume.

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APPENDIX

Register of Neutron Probe Users

Where within one establishment several persons use probes for different purposes, their names are listed individually but otherwise only the name of the principal investigator is given. In University and Polytechnic departments, work has often been conducted by post-graduate research students but only the names of research supervisors are given. The register intends to give a very brief indication of the nature of the work that is and has been conducted.

The following abbreviations have been used for this purpose:

Nature of Work Res - Research Teach - Teaching Cons - Consultancy

Field of work Agric - Agricultural Hortic - Horticultural Orch - Orchard
Hydrol - Hydrological Eng - Engineering

Type of operation Plot - Plot type experiments Field - Monitoring of several sites in different locations (eg. representing different soil series) Catch - Catchment Studies.

AGRICULTURAL AND HORTICULTURAL RESEARCH STATIONS

Brooms Barn Experimental Station Higham, Bury St Edmunds Suffolk IP28 6NP	Dr A P Draycott A B Messem	Res-Agric-Plot
East Malling Research Station Maidstone, Kent ME19 6BJ	Dr D Atkinson P Hamer	Res-Orch-Plot
Grassland Research Institute Hurley, Maidenhead, Berks SL6 5LR	E A Garwood	Res-Agric-Plot
Jealott's Hill Research Station Bracknell, Berks RG12 6EY	M Gowman	Res-Agric-Plot
Letcombe Laboratory Wantage, Oxon OX12 9JT	Dr M J Goss	Res-Agric/Hydrol-Plot
Levington Research Station Fisons Fertilizer Division Ipswich, Suffolk IP10 OLU	Dr F Cope	Res/Consult-Agric-Plot
Long Ashton Research Station Long Ashton Bristol BS18 9AF	Dr G Stinchcombe Pomology Section	Res-Orch-Plot
	Dr J J Landsberg M W Huxley Microclimatology Section	Res-Orch-Plot
Macaulay Institute for Soil Research Craigiebuckler Aberdeen AB2 2QJ	Dr G D Buchan	Res-Agric-Plot
National Vegetable Research Station Wellesbourne, Warwicks CV35 9EF	Dr H R Rowse D A Stone Soil Science Department	Res-Agric/Hortic-Plot
	Dr D Gray Plant Physiology Department	Res-Agric/Hortic-Plot
Plant Breeding Institute Maris Lane, Trumpington, Cambridge CB2 2LQ	Dr P Innes	Res-Agric-Plot
Rothamsted Experimental Station Harpenden, Herts AL5 2JQ	Dr P J Welbank Botany Department	Res-Agric-Plot
	N J Brown Physics Department	Res-Agric-Plot
	Dr A H Weir Soil and Plant Nutrition	Res-Agric-Plot
	Dr K Evans Nematology Department	Res-Agric-Plot
Scottish Horticultural Research Institute Invergowrie, Dundee DD2 5DA	Dr D K L MacKerron	Res-Agric/Hortic-Plot
Scottish Institute of Agricultural Engineering Bush Estate, Penicuik, Midlothian, GH26 OPH	J C Ball J K Henshall	Res-Agric-Plot

OTHER RESEARCH ESTABLISHMENTS

Building Research Station Bucknalls Lane, Garston, Watford, Herts WD2 7JR	R Driscoll	Res-Eng-Field
Institute of Hydrology Maclean Building, Crowmarsh Gifford, Wallingford, Oxon OX10 8BB	J P Bell	Res-Hydrol/Agric-Plot/ Field/Catch
Soil Survey of England and Wales Rothamsted Experimental Station, Harpendon, Herts AL5 2JQ	A J Thomasson	Res-Agric-Field
National Vegetable Research Station Soil Survey Office, Wellesbourne, Warwicks. CV35 9EF	W A D Whitfield	Res-Agric-Field
Soil Survey Office Shardlow Hall, Shardlow, Derby DE7 2GN	D Hall	Res-Agric-Field
Institute for Terrestrial Ecology Monkswood Experimental Station, Abbots Ripton, Nr Huntingdon, Cambs PE17 2LS	A J P Gore	Res-Agric-Plot
Transport and Road Research Laboratory Old Wokingham Road, Crowthorne, Berks RG11 6AU	L H Watkins	Res-Hydrol/Eng-Field Catch
Water Research Centre PO Box 16, Medmenham, Nr Marlow, Bucks SL7 2HD	D B Oakes	Res-Hydrol/Agric-Plot/ Field/Catch

MINISTRY OF AGRICULTURE, FISHERIES AND FOOD

AGRICULTURAL ADVISORY CENTRES

(including Scotland)

Eastern Region ADAS, Brooklands Avenue Cambridge CB2 2DR	J R Archer	Res-Agric-Plot
East Midland Region ADAS, Shardlow Hall, Shardlow Derby DE7 2GN	R W Swain	Res-Agric/Hydrol-Plot
East of Scotland College of Agriculture West Mains Road, Edinburgh EH9 3JG	R B Speirs	Res-Agric-Plot
Field Drainage Experimental Unit ADAS, Anstey Hall, Maris Lane Trumpington, Cambridge CB2 2LF	S Le Grice	Res-Agric/Hydrol-Plot
Southern Region ADAS, Government Buildings, Coley Park, Reading RG1 6DT	J P Grylls	Res-Agric-Plot
Southern Region ADAS, Olantigh Road, Wye, Kent TN15 SE5	M J Marks	Res-Agric-Plot

South Western Region ADAS, Burghill Road, Westbury on Trym, Bristol BS10 6NJ	G A Wadsworth	Res-Agric-Plot/Field
South Western Region ADAS, Staplake Mount, Starcross, Exeter EX6 8PE	Dr A D Hughes I Hodgson	Res-Agric-Plot
Welsh Office Agriculture Department Soil Science Department, WOAD, Trawscoed, Aberystwyth, Dyfed SY23 4HT	R J W Wright	Res-Agric/Hydrol-Plot
West Midlands Region ADAS, Woodthorne, Wolverhampton, WV6 8TQ	S J Richardson	Res-Agric-Plot
Yorkshire and Lancashire Region, ADAS, Government Buildings Lawnswood, Leeds LS16 5PY	D Hewgill	Res-Agric-Plot

WATER AUTHORITIES

Anglian Water Authority Hydrology Section, Lincolnshire River Division, 50 Wide Bargate, Boston, Lincs PE1 6SA	K Powell A Papaiouannou	Res-Hydrol-Catch
North West Water Authority Rivers Division, New Town House, Buttermarket Street, Warrington, WA5 3LW	R Rushton	Res-Hydrol-Catch
Severn Trent Water Authority Trent Area Unit, Trentside, West Bridgeford, Nottingham, NG2 5FA	G Chubb	Res-Hydrol/Agric-Catch
Severn Trent Water Authority Severn Area Unit, 64 Albert Road North, Malvern, Worcestershire WR14 2TL	R Goodhew	Res-Hydrol/Agric-Catch
Southern Water Authority Sussex Area Resource Planning Office, Falmer, Brighton, East Sussex BN1 9PY	D Izatt	Res-Hydrol-Field/Catch
Yorkshire Water Authority Directorate of Resource Planning 21 Park Square South, Leeds LS1 2QG	R Couchee Mrs O Bielby	Res-Hydrol/Agric-Catch/ Field

POLYTECHNICS

Lanchester (Coventry) Polytechnic Priory Street, Coventry CV1 5FB	Dr I Foster Department of Geography	Res/Teach-Hydrol-Field
Newcastle Polytechnic Ellison Place, Newcastle upon Tyne NE1 8ST	J R Bevan Department of Geography	Res-Hydrol-Catch

Plymouth Polytechnic Drakes Circus, Plymouth, Devon PL4 8AA	Miss J Alexander School of Environmental Sciences	Res-Hydrol-Catch
Wolverhampton Polytechnic Wulfrund Street, Wolverhampton WV1 1LY	A Harrison-Reed Department of Geography	Res-Agric/Hydrol-Plot

UNIVERSITIES

University of Aberdeen Meston Walk, Aberdeen AB9 2UE	Dr C E Mullins Department of Soil Science	Res/Teach-Agric-Plot
University College of Wales Llandinam Building, Penglais Aberystwyth, Dyfed SY23 2AX	Dr B E Davies Department of Geography	Res-Hydrol/Agric-Field
University of Aston Gosta Green, Birmingham B4 7ET	W J Walley Department of Civil Engineering	Res-Agric/Hydrol-Field/Plot
The Queens University of Belfast Newforge Lane, Belfast BT9 5PX	Dr M K Garret Agriculture and Food Chemistry Department	Res-Agric-Plot
The Queens University of Belfast David Keir Building, Stranmillis Road, Belfast BT7 1NN	P N Luu Department of Civil Engineering	Res-Hydrol-Catch
Birkbeck College 7-15 Gresse Street, London W1P 1PA	Dr I Reid Dr L E Frostick Department of Geography	Res/Teach-Agric/Hydrol-Plot
University of Bristol University Road, Bristol, BS8 1SS	A D Wilson Department of Geography	Res/Teach-Agric/Hydrol Plot
New University of Ulster Coleraine, NI BT52 1SA	Dr D Wilcock School of Biological and Environmental Studies	Res/Teach-Agric/Hydrol-Plot
University College, Dublin Agriculture Building, Belfield, Dublin 4, Eire	Dr G Mullen Department of Agricultural Chemistry and Soil Science	Res-Agric-Plot/Field
Dundee University Dundee DD1 4HN	Dr A S Tricker Department of Geography	Res/Teach-Hydrol-Plot/Field
University of East Anglia Norwich NR4 7TJ	Dr P Scammel Dr R D Hey Department of Environmental Science	Res/Teach-Agric/Hydrol-Field/Plot
University of Hull Hull HU6 7RX	Dr R C Ward Department of Geography	Res/Teach-Hydrol-Plot/Field
Imperial College of Science & Technology, Imperial College Road, London SW7 2BU	Dr H S W Wheater Department of Civil Engineering	Res-Hydrol-Plot/Catch

Kings College Strand, London WC2R 2LS	Dr J Pitman Department of Geography	Res/Tech-Hydrol-Plot/Catch
University of Leeds Leeds LS2 9JT	Dr J G Lockwood Department of Geography	Res/Teach-Hydrol-Catch/Field
London School of Economics Houghton Street, London WC2A 2AE	Dr J Thornes Dr M J Waylen Department of Geography	Res-Hydrol-Plot
National College of Agricultural Engineering, Silsoe, Bedford MK45 4HS	Dr M K U Carr	Res/Teach-Agric-Plot
University of Newcastle-upon-Tyne Newcastle upon Tyne NE1 7RU	Dr J Mawdsley Department of Civil Engineering Dr L W Hanna Department of Geography	Res-Hydrol-Plot
University of Nottingham Sutton Bonnington, Loughborough LE12 5RD	Dr M McGowan Department of Environmental Physiology	Res/Teach-Agric/Hydrol-Plot/Field
University of Oxford OX1 3PF	Dr R E White Department of Agricultural Science	Res-Agric/Hydrol-Catch/Plot
University of Reading London Road, Reading RG1 5AQ	Dr S Nortcliffe T Moseley D Payne Department of Soil Science	Res-Agric-Plot
Wye College Nr Ashford, Kent TN25 5AH	Dr P T Gooderham P T Brooks Department of Soil Physics	Res-Agric-Plot

MISCELLANEOUS

Fisons	see Levington Research Station	
I C I	see Jealott's Hill Research Station	
Redland Purle Ltd Claydons Lane, Rayleigh, Essex SS6 7UW	T E Roberts	Res-Hydrol-Field
Tree Conservation Ltd 37 Wallingford Street, Wantage Oxfordshire OX10 8AU	Dr P G Biddle	Cons/Res-Trees-Field