

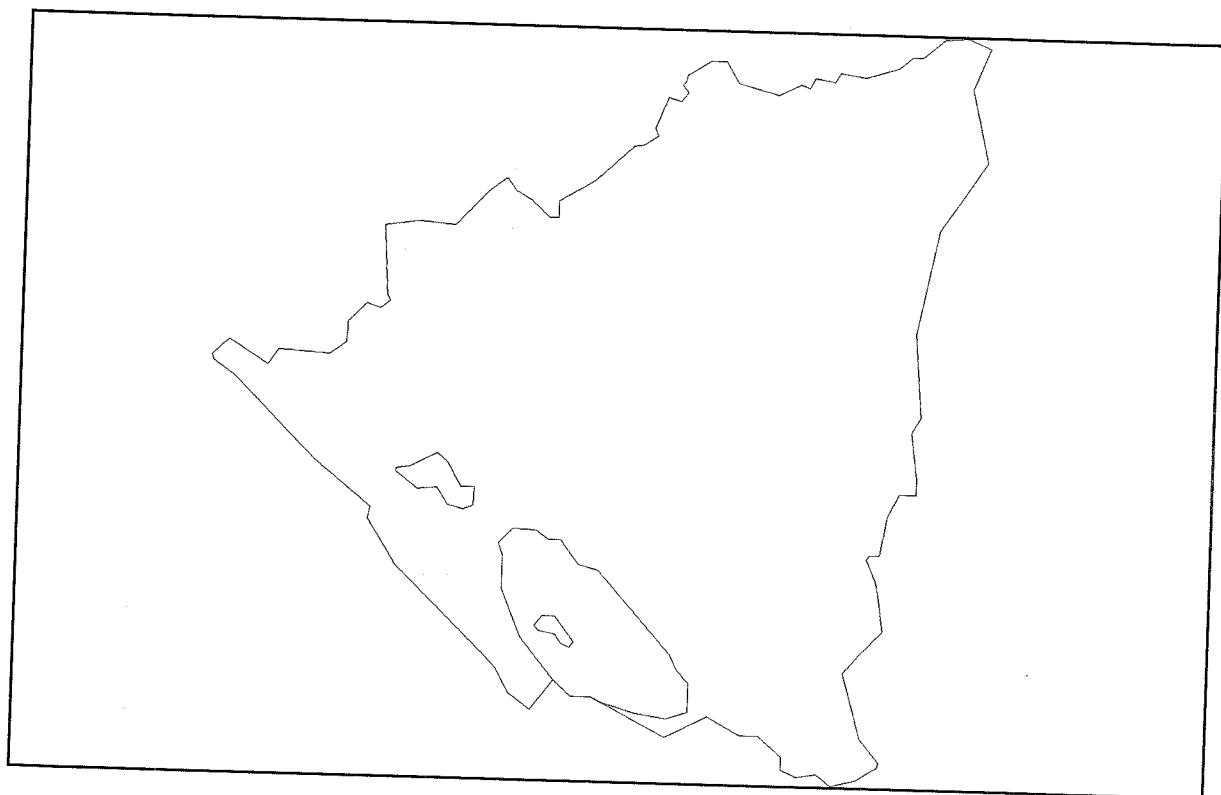
NI 1995.04

Country Report 11

DRAFT

Soil Reference Profiles of Nicaragua

Field and Analytical Data



Universidad Nacional Agraria
International Soil Reference and Information Centre

October 1995

26804

Country Report 11

DRAFT

Soil Reference Profiles of Nicaragua

Field and Analytical Data

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Reference citation

UNA & ISRIC (1994). Soil reference profiles of Nicaragua. Field and analytical data. Country Report 11. (E. Acuña Espinales, J.H. Kauffman & A.W. Vogel, compilers)

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FOREWORD

National Soil Reference Collection and Database of Nicaragua

The objective of this Country Report is to provide comprehensive field and analytical data of a number of reference soils representative for the major soils of Nicaragua. The sites were carefully selected, described and sampled for incorporation in the Central American Soil Reference Collection and Database (CASREC). The study was carried out by the "Universidad Nacional Agraria" (UNA), the "Centro Agronómico Tropical de Investigación y Enseñanza" (CATIE), Costa Rica and the International Soil Reference and Information Centre (ISRIC), The Netherlands. Soil samples were analyzed in their respective soil laboratories. Additional information on the reference soils is provided in a series of Soil Briefs NI 1, NI 2 and NI 3, comprising information about the environment and soils, such as characterization, classification and an assessment of soil/land qualities.

All sites are located in the Pacific Region of Nicaragua. The sites were selected on a number of criteria, such as major soil type, extension, advanced stage of weathering and production potential. Special attention has been given to soils with a phenomena called "talpetate", a hardened layer in the soil profile.

At present the collection comprises 11 soil reference profiles. From each reference soil three undisturbed profiles were taken, specially preserved and prepared into monoliths, ready for exposition. The monolith expositions of Nicaragua is housed in Managua at the Universidad Nacional Agraria. Duplicate monoliths are included in CATIE's Central American monolith exposition in Turrialba, Costa Rica and in ISRIC's world soil collection in The Netherlands.

The plan for a national soil reference collection was formulated in 1988 and it could be realized in the period 1990 to 1994 within the framework of ISRIC's National Soil Reference Collection Programme (NASREC).

The establishment of the soil reference collection, comprising exposition and accompanying documentation has been made possible with the support of many persons, some are specially mentioned here: Dr. D. Kass (coordinator CASREC, CATIE), M. Jimenez Hernandez (fieldwork CATIE), Ir. J.H. Kauffman (coordinator NASREC programme), and staff members of the Department of Soil & Water of UNA.

Ing. F. Salmeron Miranda, director Department of Soil & Water, UNA

International Soil Reference Collection and Database

The International Soil Reference and Information Centre (ISRIC), founded in 1966 as an initiative of the International Society of Soil Science (ISSS), has a mandate to collect and disseminate scientific knowledge about soils for the purpose of a better understanding of their formation, characterization, classification, distribution and capability for sustained land use at local, national, and global scales. One of ISRIC's main objectives is to assemble soil profiles, soil samples and associated information to illustrate the units of the FAO-Unesco Soil Map of the World. To date, the world soil collection consists of about 800 reference soils from 60 countries, accompanied by soil and environmental data. The collection is supported by a soil map collection, soil reports library, a thin section collection and a slide collection.

The National Soil Reference Collection Programme (NASREC), supported by the Directorate General of International Cooperation of the Netherlands within the Action Plan of National Soil Policies of UNEP, and through ISRIC's own budget has been instrumental to achieve this objective. ISRIC greatly appreciates the cooperation of UNA in its efforts to bring together a National Soil Reference Collection of Nicaragua.

The collected information of the reference soil profiles is stored in ISRIC's Soil Information System (ISIS), a database management system for storing and retrieving data on geology, geomorphology, hydrology, soil morphology, soil chemical and physical characteristics, and climate.

To disseminate its data, ISRIC has combined the different types of information into several publication series. Each series aims to address the needs of those working in one of the many fields of research using soil data and soil related data. One of these series is the Country Report.

The Country Reports, containing all ISRIC held data on soils and associated information of a specific country are generated by ISIS. Additional information on literature references, small scale maps, and a list of slides available in the ISRIC Slide Database is included. The country reports are jointly published by the national institution involved in the collection and ISRIC. A list of country reports (in press) is given on the back cover of this report. We are very pleased to release the draft Nicaragua Country Report at the occasion of the XVth World Congress of Soil Science.

Any comments on the Country report in general or on the presentation of the data in particular is highly appreciated and may be communicated to the directors of either UNA or ISRIC

Dr. L.R. Oldeman, Director ISRIC

Country Reports can be pursued through ISRIC or the national institution of the country concerned. Publications based on the Country Reports should always explicitly indicate the information source. To order Country Reports please contact:

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Carretera Norte Km 12.5
Apartdado Postal 453
Managua
Nicaragua

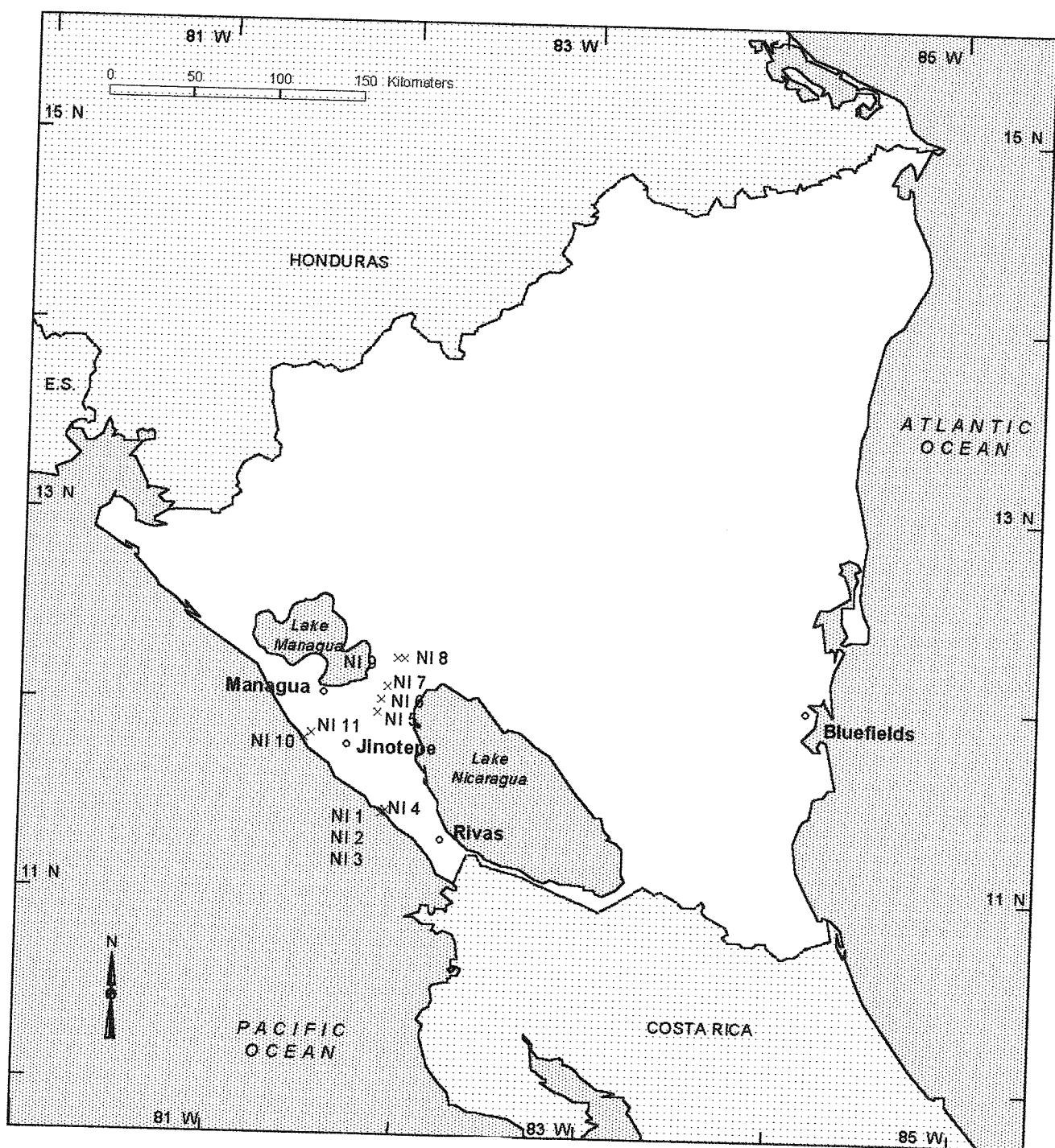
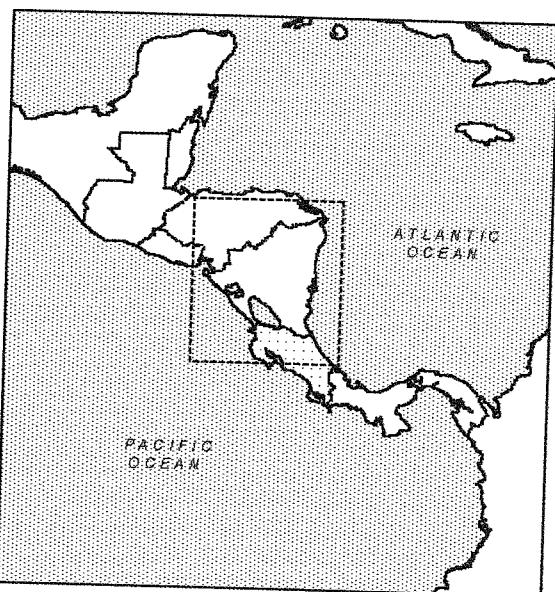
Telephone (505 2) 31619
Fax (505 2) 31950

REFERENCE SOILS OF NICARAGUA

- × Reference soil
- Town
- State boundary
- ~~~~ River
- Ocean, lake

October 1995
Projection Lambert

The designation employed and the presentation of material in this map do not imply the expression of any opinion whatsoever on the part of ISRIC concerning the legal status of any country, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.



SUMMARIZED INFORMATION OF THE SOIL REFERENCE PROFILES NI001 TO NI011

ISIS_ID ¹⁾	FAO-88 ²⁾	ST-92 ³⁾	PARENT MATERIAL	CLIMATE ⁴⁾	LANDFORM	LAND UTILIZATION TYPE	VEGETATION	DRAINAGE CLASS	ALT ⁵⁾
NI001	Eutric Fluvisol*	Ustifluvent*	Alluvium	Aw ⁶⁾	Alluvial plain		Semi deciduous forest	Well	?
NI002	Vertic Cambisol*	Ustopepti*	Residual material	Aw ⁶⁾	Low hill		Semi deciduous woodland	Moderate	?
NI003	Vertic Luvisol*	Haplustalf*	Residual material	Aw ⁶⁾	Low hill		Semi deciduous woodland	Moderate	?
NI004	Ferric Luvisol*		Residual material	Aw ⁶⁾			Semi deciduous woodland	Moderately well to well	?
NI005	Vitric Andosol	Ustivitrand	Volcanic ejecta	Aw ⁶⁾			Semi deciduous woodland	Well	?
NI006	Molic Andosol	Haplustand	Volcanic ejecta	Aw ⁶⁾	Caldera		Semi deciduous forest	(Somewhat) excessive	250
NI007	Haplic Phaeozem	Durustoll	Volcanic ejecta	Aw ⁶⁾	Piedmont	Cultivated pasture		Well	190
NI008	Chromic Luvisol	Rhodustalf	Alluvium	Aw ⁶⁾	Piedmont	Medium level arable farming		Well	130
NI009	Eutric Vertisol	Haplustert	Alluvium	Aw ⁶⁾	Plain	High level arable farming		Well	80
NI010	Haplic Phaeozem	Durustol	Volcanic ejecta	Aw ⁶⁾	Plain	Semi natural grassland		Imperfectly	80
NI011	Haplic Phaeozem	Durustoll	Unconsolidated	Aw ⁶⁾	Piedmont	Shrubland	Moderately well to well	?	50
				Plain	Medium level arable farming		Moderately well to well		50

1) ISIS Identification code

2) FAO-Unesco (1988); * (1974)

3) USDA Soil Taxonomy (1992); * (1975)

4) Köppen
5) Altitude in metres

SOIL INFORMATION SHEETS

Generated by the ISRIC Soil Information System (ISIS, version 4.0)

Draft

ISIS 4.0 data sheet of monolith NI001

Country : NICARAGUA

Page : 1

Print date (dd/mm/yy) : 04/06/94

FAO/UNESCO (1988) :
 USDA/SCS SOIL TAXONOMY (1992) : , loamy, isohyperthermic
 (1974 : Eutric Fluvisol)
 (1975 : mollic ustifluvent)

DIAGNOSTIC CRITERIA
 USDA/SCS (1992) : Soil moisture regime : ustic
 FAO (1974) & USDA (1975) : Soil moisture regime : ustic

(CLASSIFICATIONS ARE FIELD CLASSIFICATIONS)

LOCATION	: Carazo department, Refugio de Chacocente	
AUTHOR(S)	Latitude :	Longitude :
	: Kauffman/Sabogal	
GENERAL LANDFORM	: alluvial plain	
PHYSIOGRAPHIC UNIT	: terrace	
SLOPE	Gradient :	Aspect :
POSITION OF SITE	: 1%	
MICRO RELIEF	: Kind :	
SURFACE CHAR.	Rock outcrop :	Stoniness : nil
	Cracking :	Slaking/crusting : nil
	Salt :	Alkali : nil
SLOPE PROCESSES	Soil erosion : nil	
PARENT MATERIAL	1 : alluvium	
Remarks	Texture :	derived from :
	: Rio Escalante	
EFFECTIVE SOIL DEPTH(cm)	: 150	
WATER TABLE	Depth(cm) :	Kind : no watertable observed
DRAINAGE	: well	
PERMEABILITY	: high	No slow permeable layer(s) cm
FLOODING	Frequency :	Run off : rapid
MOISTURE CONDITIONS PROFILE	: 0 - 150 cm moist	

VEGETATION	Type : semi deciduous forest	Status : primary
Landuse/vegetation remarks	: see remarks	
ADDITIONAL REMARKS : Only very occasionally flooding by the Rio Escalante will occur. Riverine forest, dominant species are: <i>Pithecellobium saman</i> (Genicaro), <i>Trichilia hirta</i> (Palo de piojo), <i>Thounidium decandrum</i> (Melerio), <i>Capparis</i> spp. (Naranjillo) <i>Gyrocarpus americanus</i> (Talatare), <i>Tabebuia chrysantha</i> ssp. <i>neochrysantha</i> (Cortez), <i>Sterculia apetata</i> (Panama) Short soil description: very deep, well drained, dark brown loam; very porous and well rooted throughout.		

		Köppen: Aw											
CLIMATE :		Station: RIVAS	11 26 N/ 85 59 W	70 m a.s.l	30 km ESE of site						Relevance: good		
		Station: NANDAIME	11 45 N/ 86 3 W	95 m a.s.l	30 km NNE of site						Relevance: good		
			No. years of record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
EP Penman	mm	20	132	137	165	172	169	145	148	158	148	139	124
relative humidity	%	20	78	74	74	72	77	84	85	80	82	83	82
precipitation	mm	20	10	5	1	4	179	284	153	180	273	349	82
T mean	°C	20	25.8	26.5	27.2	28.0	27.9	27.1	26.8	26.7	26.6	26.2	26.1
													25.6
													26.7
EP Penman	mm	20	135	134	162	166	167	145	153	151	135	132	125
relative humidity	%	23	87	91	119	115	112	91	85	92	97	98	81
relative humidity	%	20	76	75	76	76	79	84	83	84	87	86	78
precipitation	mm	20	10	3	3	16	171	269	137	146	319	313	80
T mean	°C	20	26.3	26.5	27.3	28.1	28.2	27.0	26.9	26.8	26.5	26.2	26.1
													26.3
													26.9

Draft

ISIS 4.0 data sheet of monolith NI001

Country : NICARAGUA

Page : 2

Print date (dd/mm/yy) : 04/06/94

PROFILE DESCRIPTION :

- Ah 0 - 20 cm. very dark grayish brown (10YR 3.0/2.0, moist) loam; moderate fine subangular blocky structure; slightly sticky, slightly plastic, very friable; many medium continuous impeded tubular pores and many fine tubular pores; many fine roots throughout and many medium roots throughout; very frequent worm channels and coprogenic elements; diffuse smooth boundary to
- Bw1 20 - 57 cm. dark brown (10YR 3.0/3.0, moist) loam; weak to moderate very fine subangular blocky structure; slightly sticky, slightly plastic, very friable; common medium tubular pores and many fine tubular pores; many fine roots throughout; frequent worm channels; abrupt smooth boundary to
- Bw2 57 - 64 cm. dark yellowish brown (10YR 3.0/4.0, moist); very weak very fine subangular blocky structure; non sticky, non plastic, loose; many very fine tubular pores; common fine roots throughout; abrupt
- Bw3 64 - 83 cm. dark brown (10YR 3.0/3.0, moist) loam; weak to moderate very fine subangular blocky structure; slightly sticky, slightly plastic, very friable; few medium tubular pores and many fine tubular pores; many fine roots throughout; few worm channels; gradual smooth boundary to
- Bw4 83 - 95 cm. very dark grayish brown (10YR 3.0/2.0, moist) loam; moderate very fine subangular blocky structure; slightly sticky, slightly plastic, very friable; few medium tubular pores and many fine tubular pores; many fine roots throughout;

ANALYTICAL DATA :

Hor. no.	Top - Bot mm	>2 mm	2000 1000 500 250 100					TOT 50 20 2	TOT 20 2 SILT μm	<2 DISP μm	BULK DENS	pF- 0.0 1.0 1.5 2.0 2.3 2.7 3.4 4.2	
			1000	500	250	100	SAND						
1	0 - 20	-	0	0	1	19	18	38	16	22	39	24	-
2	20 - 60	-	0	0	1	15	18	34	18	22	40	26	-
3	60 - 70	-	0	0	3	43	15	61	9	14	23	16	-
4	70 - 90	-	0	0	0	3	20	23	25	26	51	26	-
5	90 - 140	-	0	0	0	3	19	22	25	26	51	27	-
6	140 - 160	-	0	23	32	14	5	74	3	11	15	11	-

Hor. no.	pH- H2O	-- CaCO3	ORG- KCL	MAT. C	EXCH Ca	CAT. N	--- EXCH Mg	AC. K Na sum H+Al	CEC Al soil clay OrgC	--- ECEC	BASE SAT	Al SAT	EC mS/cm
	%	%	%	---- cmol(+)/kg	-----	-----	-----	-----	-----	-----	%	%	
1	7.3	6.7	1.6	1.72	-	37.9	2.4	1.1	0.1 41.5	-	33.8	142	6.0
2	7.4	6.5	1.5	1.33	-	34.8	2.1	0.7	0.1 37.7	-	34.3	134	4.7
3	7.8	6.6	1.6	0.32	-	31.6	1.7	0.5	0.1 33.9	-	26.2	169	1.1
4	7.8	6.8	2.0	0.86	-	45.7	2.1	0.5	0.3 48.6	-	35.6	136	3.0
5	7.9	6.8	1.8	0.86	-	52.9	1.7	0.5	0.2 55.3	-	36.3	136	3.0
6	8.2	6.8	1.9	0.17	-	35.9	1.4	0.3	0.3 37.9	-	23.7	212	0.6

remarks (hor. 1 - 6): P-Olsen= -1

CLAY MINERALOGY (1 very weak..., 8 very strong) / EXTRACTABLE Fe Al Si Mn (by AMM. OXALATE(o), Na DITHIONITE(d) & PYROPHO(p))

Hor.

no. MI VE CH SM KA HA ML QU FE GI GO HE Fe(o) Al(o) Si(o) Fe(d) Al(d) Fe(p) Al(p) Pret pHNaF

1	-	-	-	8	3	-	2	-	-	0.30	0.18	0.13	-
2	-	-	-	8	3	-	2	-	-	0.28	0.19	0.13	-
3	-	-	-	8	3	-	2	-	-	0.20	0.15	0.16	-
4	-	-	-	8	3	-	2	-	-	0.20	0.18	0.14	-
5	-	-	-	8	3	-	2	-	-	0.22	0.19	0.15	-
6	-	-	-	8	3	-	2	-	-	0.20	0.14	0.13	-

Draft

ISIS 4.0 data sheet of monolith NI002

Country : NICARAGUA

Page : 1

Print date (dd/mm/yy) : 04/06/94

FAO/UNESCO (1988) :
 USDA/SCS SOIL TAXONOMY (1992) : , clayey, isohyperthermic
 LOCAL CLASSIFICATION : chocolito (1974 : Vertic Cambisol)
 (1975 : vertic ustropept)

DIAGNOSTIC CRITERIA
 USDA/SCS (1992) : Soil moisture regime : ustic
 FAO (1974) & USDA (1975) : Diagnostic horizons : cambic
 : Soil moisture regime : ustic

(CLASSIFICATIONS ARE FIELD CLASSIFICATIONS)

LOCATION : Departament of Carazo, Refugio de Chacocente
 Latitude : Longitude :
 AUTHOR(S) : Kauffman/Sabogal Altitude : 0 (m.a.s.l.)
 Date (mm.yy) : 11.91

GENERAL LANDFORM : low hill Topography : undulating
 PHYSIOGRAPHIC UNIT : valley, weakly undulating

SLOPE Gradient : 4% Aspect : Form :

POSITION OF SITE :

MICRO RELIEF Kind :

SURFACE CHAR. Rock outcrop : nil Stoniness : nil
Cracking : nil Slaking/crusting :
Salt : nil Alkali : nil

SLOPE PROCESSES Soil erosion :

PARENT MATERIAL 1 : residual material derived from : interbedded sedimentary rock
 Texture :
 Remarks :

EFFECTIVE SOIL DEPTH(cm) : 80

WATER TABLE Depth(cm) : Kind : no watertable observed

DRAINAGE :

PERMEABILITY : moderate

FLOODING Frequency : No slow permeable layer(s) cm

MOISTURE CONDITIONS PROFILE : 0 - 150 cm moist Run off : medium

VEGETATION Type : semi deciduous woodland Status : secondary
 Landuse/vegetation remarks : 6 years of sec. forest (see remarks)

ADDITIONAL REMARKS :

Formerly agricultural exploitation, mainly sorghum (verbal comm.). Now six years of secondary forest, dominant species: Lonchocarpus minimifloras (Chaperno), Acacia costaricensis (Cornizuelo), Stemnadenia spp. (Cachito).

The B horizon has occasionally pockets of grey clay (10 YR 5/2).

The CB horizon has pockets of light grey clay (10 YR 5/1).

Short description: Moderately deep, well drained, very dark grey clay; roots penetrates easily the weathered rock C horizon, therefore effective soil depth > 80 cm

CLIMATE :	Köppen: Aw"											
	Station: RIVAS	11 26 N / 85 59 W	70 m a.s.l.	30 km ESE of site				Relevance: good				
Station: NANDAIME	11 45 N / 86 3 W	95 m a.s.l.	30 km NNE of site				Relevance: good					
	No. years of record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
EP Penman mm	20	132	137	165	172	169	145	148	158	148	139	124
relative humidity %	20	78	74	74	72	77	84	85	80	82	83	80
precipitation mm	20	10	5	1	4	179	284	153	180	273	349	82
T mean °C	20	25.8	26.5	27.2	28.0	27.9	27.1	26.8	26.7	26.6	26.2	26.1
EP Penman mm	20	135	134	162	166	167	145	153	151	135	132	125
relative humidity %	23	87	91	119	115	112	91	85	92	97	98	128
relative humidity %	20	76	75	76	76	79	84	83	84	87	86	81
precipitation mm	20	10	3	3	16	171	269	137	146	319	313	82
T mean °C	20	26.3	26.5	27.3	28.1	28.2	27.0	26.9	26.8	26.5	26.2	26.1
												26.3
												26.9

Draft

ISIS 4.0 data sheet of monolith NI002

Country : NICARAGUA

Page : 2

Print date (dd/mm/yy) : 04/06/94

PROFILE DESCRIPTION :

- Ah 0 - 5 cm. very dark gray (10YR 2.5/1.0, moist) clay; weak fine to medium subangular blocky structure; sticky, plastic, friable; common fine interstitial pores; few fine roots throughout; few fine weathered fragments; clear smooth boundary to
- B 5 - 40 cm. 10YR 2.5/0.0, moist clay; strong coarse angular blocky structure; sticky, plastic, firm; common fine interstitial pores; common fine roots throughout; few fine weathered fragments; gradual smooth boundary to
- BC 40 - 50 cm. dark gray (10YR 4.0/1.0, moist) clay; moderate coarse angular blocky structure; sticky, plastic, firm; common fine interstitial pores;; frequent fine weathered fragments; clear smooth boundary to
- CB 50 - 80 cm. gray (10YR 6.0/1.0, moist) very gravelly clay; common fine roots throughout;

ANALYTICAL DATA :

Hor. no.	Top - Bot mm	>2 mm	2000 1000 500 250 100					TOT 50 20	TOT 20 2 SILT μm	<2 DISP μm	BULK DENS	pF- 0.0 1.0 1.5 2.0 2.3 2.7 3.4 4.2	
			1000	500	250	100	SAND						
1	0 - 5	-	2	2	4	3	12	6	17	23	65	-	-
2	5 - 40	-	3	2	1	3	2	10	4	15	19	71	-
3	40 - 50	-	3	3	3	3	2	14	10	14	24	63	-
4	50 - 75	-	5	3	1	3	2	13	7	28	35	53	-
5	75 - 100	-	3	4	3	3	2	14	8	37	44	42	-

Hor. no.	pH-	--	CaCO ₃	ORG-	MAT.	EXCH	CAT.	-----	-----	-----	EXCH	AC.	CEC	-----	-----	---	BASE	AL	EC 2.5
	H ₂ O	KCl	%	C	N	Ca	Mg	K	Na	sum	H+Al	Al	soil	clay	OrgC	ECEC	SAT	SAT	mS/cm
1	6.8	5.8	1.6	2.88	-	54.9	7.4	1.5	0.2	64.0	-	-	58.9	91	10.1	64.0	109	-	0.21
2	6.2	4.6	-	0.99	-	58.6	7.6	0.3	0.5	67.0	-	-	60.4	85	3.5	67.0	111	-	0.06
3	6.1	4.3	-	0.57	-	51.4	5.4	0.3	0.7	57.8	-	-	53.6	85	2.0	57.8	108	-	0.07
4	6.3	4.2	-	0.21	-	49.6	4.0	0.3	0.8	54.7	-	-	50.9	97	0.7	54.7	107	-	0.05
5	6.6	4.4	1.1	0.11	-	45.5	2.5	0.3	0.8	49.1	-	-	46.8	113	0.4	49.1	105	-	0.07

remarks (hor. 1 - 5): P-Olsen= -1

CLAY MINERALOGY (1 very weak, ..., 8 very strong) / EXTRACTABLE Fe Al Si Mn (by AMM. OXALATE(o), Na DITHIONITE(d) & PYROPHO(p))

Hor.

no. MI VE CH SM KA HA ML QU FE GI GO HE Fe(o) Al(o) Si(o) Fe(d) Al(d) Fe(p) Al(p) Pret pHNaF

1	-	-	8	3	-	2	-	-	-	0.31	0.25	0.05	-	-	-	-	-	-
2	-	-	8	3	-	3	-	-	-	0.17	0.21	0.02	-	-	-	-	-	-
3	-	-	8	3	-	3	-	-	-	0.12	0.16	0.06	-	-	-	-	-	-
4	-	-	8	2	-	2	-	-	-	0.09	0.13	0.05	-	-	-	-	-	-
5	-	-	8	-	-	2	-	-	-	0.07	0.10	0.02	-	-	-	-	-	-

Draft

ISIS 4.0 data sheet of monolith NI003

Country : NICARAGUA

Page : 1

Print date (dd/mm/yy) : 04/06/94

FAO/UNESCO (1988) :
 USDA/SCS SOIL TAXONOMY (1992) : , clayey

(1974 : Vertic Luvisol)
 (1975 : vertic haplustalf)

DIAGNOSTIC CRITERIA

USDA/SCS (1992)	: Soil moisture regime :
FAO (1974) & USDA (1975)	: Diagnostic horizons : argillic, ochric
	: Soil moisture regime :

(CLASSIFICATIONS ARE FIELD CLASSIFICATIONS)

LOCATION	: Department of Carazo, Biological station Chacocente		
AUTHOR(S)	Latitude :	Longitude :	Altitude : 0 (m.a.s.l.)
	: Kauffman/Rodriguez		Date (mm.yy) : 11.91
GENERAL LANDFORM	: low hill		
PHYSIOGRAPHIC UNIT	: dissected valley		
SLOPE	Gradient :	Topography : undulating	
POSITION OF SITE	: 4% slope		
MICRO RELIEF	Kind :	Aspect :	
SURFACE CHAR.	Rock outcrop : nil	Stoniness : nil	Form : convex
	Cracking : small cracks	Slaking/crusting :	
	Salt : nil	Alkali : nil	
SLOPE PROCESSES	Soil erosion :		
PARENT MATERIAL	1 : residual material		
Remarks	Texture : derived from : interbedded sedimentary rock : see remarks		
EFFECTIVE SOIL DEPTH(cm)	: 150		

WATER TABLE	Depth(cm) :	Kind : no watertable observed	
DRAINAGE	: moderately well to well		
PERMEABILITY	: moderate		
FLOODING	Frequency :	No slow permeable layer(s) cm	
MOISTURE CONDITIONS PROFILE	Run off : rapid		

VEGETATION	Type : semi deciduous woodland
------------	--------------------------------

ADDITIONAL REMARKS :
 Short description: very deep, (mod) well drained, yellowish brown clay; with a very dark brown topsoil, well rooted throughout

At the limit Bt --> BC is a thin layer of rounded stones (not weathered resistant). It may be an indication of colluvium a parent material [micromorphology!]. The BC and CB horizons are characterized by whitish spots, the abundance increasing with depth. The cutans in the Bt have been described as patchy and broken, faint and distinct.

Dry forest, major species:

Quebrado (); Jinocuabo ()

Espino negro (); Cornizuelo()

The permeability of the soil is probably not sufficient to transmit the excess of rainwater. Run-off is a common feature, resulting in natural gullies/dissecting streamlines throughout the landscape (high natural erosion).

CLIMATE :	Köppen: Aw"												
	Station: RIVAS		11 26 N/ 85 59 W		70 m a.s.l		30 km ESE of site		Relevance: good				
Station: NANDAIME		11 45 N/ 86 3 W		95 m a.s.l		30 km NNE of site		Relevance: good					
No. years of record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
EP Penman mm	20	132	137	165	172	169	145	148	158	148	139	124	125 1761
relative humidity %	20	78	74	74	72	77	84	85	80	82	83	82	80 79
precipitation mm	20	10	5	1	4	179	284	153	180	273	349	82	24 1542
T mean °C	20	25.8	26.5	27.2	28.0	27.9	27.1	26.8	26.7	26.6	26.2	26.1	25.6 26.7
EP Penman mm	20	135	134	162	166	167	145	153	151	135	132	125	128 1733
relative humidity %	23	87	91	119	115	112	91	85	92	97	98	81	78 1146
relative humidity %	20	76	75	76	76	79	84	83	84	87	86	82	79 81
precipitation mm	20	10	3	3	16	171	269	137	146	319	313	80	27 1497
T mean °C	20	26.3	26.5	27.3	28.1	28.2	27.0	26.9	26.8	26.5	26.2	26.1	26.3 26.9

PROFILE DESCRIPTION :

Ah1 0 - 4 cm. black (10YR 2.0/1.0, moist) clay; strong fine subangular blocky structure; sticky, plastic, hard; many very fine to fine tubular pores; many fine roots in mat at top of horizon; abrupt smooth boundary to

Ah2 4 - 25 cm. very dark grayish brown (10YR 3.0/2.0, moist) clay; strong medium to coarse subangular blocky structure; sticky, plastic, very hard; many very fine tubular pores and few fine tubular pores; many very fine to coarse roots throughout; gradual smooth boundary to

Ah3 25 - 43 cm. very dark grayish brown (10YR 3.0/2.0, moist) clay; moderate medium to coarse subangular blocky structure; sticky, plastic, firm; many very fine tubular pores; many fine roots throughout and common roots throughout; abrupt smooth boundary to

Bt 43 - 102 cm. yellowish brown (10YR 5.0/6.0, moist) clay; moderately coherent porous massive into weak medium to coarse subangular blocky structure; sticky, plastic, firm; continuous thin clay and sesquioxides cutans; common very fine tubular pores; many fine roots throughout; gradual smooth boundary to

BC 102 - 130 cm. sandy clay; weakly coherent porous massive structure; slightly sticky, slightly plastic, friable; few very fine tubular pores; common fine roots throughout; very frequent fine strongly weathered fragments; gradual smooth boundary to

CB/C 130 - 150 cm. sandy clay loam; weakly coherent porous massive structure; slightly sticky, slightly plastic, friable; few very fine tubular pores; few fine roots throughout; dominant fine strongly weathered fragments;

ANALYTICAL DATA :

Hor. no.	Top - Bot mm	>2 1000	2000 500	1000 250	500 100	250 50	100 SAND	TOT 20	50 2 SILT	20 TOT	<2 μm	DISP	BULK DENS	pF- 0.0	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -
1	0 - 4	- 0	1	1	3	3	8	4 23	27	66	-	-	-	-	-	-	-	-	-
2	4 - 25	- 0	0	1	2	2	5	7 28	34	61	-	-	-	-	-	-	-	-	-
3	25 - 43	- 1	1	1	2	1	5	7 21	28	67	-	-	-	-	-	-	-	-	-
4	43 - 70	- 1	1	1	2	2	7	7 22	30	64	-	-	-	-	-	-	-	-	-
5	70 - 102	- 1	1	1	3	3	10	7 27	34	57	-	-	-	-	-	-	-	-	-
6	102 - 130	- 0	2	5	10	6	23	9 27	36	41	-	-	-	-	-	-	-	-	-
7	130 - 150	- 0	2	3	7	5	17	9 28	36	47	-	-	-	-	-	-	-	-	-

Hor. no.	pH- H2O	-- CaCO3 KCl	ORG- C %	MAT. C %	EXCH Ca %	CAT. Mg %	-----	-----	EXCH K %	AC. sum H+Al cmol(+) / kg	CEC Al	-----	soil clay	OrgC ECEC	-----	BASE SAT %	Al SAT %	EC mS/cm
1	7.0	6.1	1.5	3.72	- 45.3	7.5	1.2	0.2	54.2	-	-	52.7	80	13.0	54.2	103	-	0.32
2	6.3	4.8	-	1.61	- 39.7	7.7	0.5	0.3	48.2	-	-	50.7	84	5.6	48.2	95	-	0.08
3	6.0	4.3	-	1.08	- 40.3	7.6	0.3	0.7	48.9	-	-	50.4	75	3.8	48.9	97	-	0.06
4	5.8	3.9	-	0.51	- 42.4	8.0	0.4	1.3	52.1	-	-	50.9	80	1.8	52.1	102	-	0.08
5	6.7	5.1	1.7	0.26	- 46.5	8.2	0.3	2.0	57.0	-	-	53.6	95	0.9	57.0	106	-	0.04
6	8.3	6.7	3.7	0.14	- 69.0	6.3	0.3	2.0	77.6	-	-	42.6	103	0.5	77.6	182	-	0.42
7	8.6	6.9	13.6	0.06	- 59.2	5.2	0.2	1.7	66.3	-	-	34.1	73	0.2	66.3	194	-	0.28

remarks (hor. 1 - 7): P-Olsen= -1

CLAY MINERALOGY (1 very weak, ..., 8 very strong) / EXTRACTABLE Fe Al Si Mn (by AMM. OXALATE(o), Na DITHIONITE(d) & PYROPHO(p))

Hor.

no. MI VE CH SM KA HA ML QU FE GI GO HE Fe(o) Al(o) Si(o) Fe(d) Al(d) Fe(p) Al(p) Pret pHNaF

1	-	-	-	8	3	-	-	2	-	-	-	0.40	0.20	0.04	-	-	-	-
2	-	-	-	8	3	-	-	2	-	-	-	0.39	0.26	0.05	-	-	-	-
3	-	-	-	8	3	-	-	2	-	-	-	0.40	0.20	0.05	-	-	-	-
4	-	-	-	8	3	-	-	2	-	-	-	0.28	0.16	0.04	-	-	-	-
5	-	-	-	8	2	-	-	2	-	-	-	0.13	0.09	0.06	-	-	-	-
6	-	-	-	8	1	-	-	2	-	-	-	0.07	0.08	0.05	-	-	-	-
7	-	-	-	8	1	-	-	2	-	-	-	0.04	0.07	0.00	-	-	-	-

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Country : NICARAGUA

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FAO/UNESCO (1988) :
 USDA/SCS SOIL TAXONOMY (1992) : , loamy
 LOCAL CLASSIFICATION : San Rafael Rivas series

(1974 : Ferric Luvisol)

DIAGNOSTIC CRITERIA
 USDA/SCS (1992) : Soil moisture regime :
 FAO (1974) & USDA (1975) : Diagnostic horizons : argillic, ochric
 : Soil moisture regime :

(CLASSIFICATIONS ARE FIELD CLASSIFICATIONS)

LOCATION	: Department Carazo, biological station Chacocente		
AUTHOR(S)	Latitude :	Longitude :	Altitude : 0 (m.a.s.l.)
	: Kauffman/Medrano		Date (mm.yy) : 11.91
GENERAL LANDFORM	: Topography : hilly		
PHYSIOGRAPHIC UNIT	: strong sloping hillside		
SLOPE	Gradient :	Aspect :	Form : convex
POSITION OF SITE	: upper slope		
MICRO RELIEF	: Kind :		
SURFACE CHAR.	Rock outcrop :	Stoniness :	nil
	Cracking :	Slaking/crusting :	
	Salt :	Alkali :	nil
SLOPE PROCESSES	Soil erosion : slight sheet		
PARENT MATERIAL	1 : residual material		derived from : interbedded sedimentary rock
Remarks	Texture :		
EFFECTIVE SOIL DEPTH(cm)	: 150		
WATER TABLE	Depth(cm) :	Kind : no watertable observed	
DRAINAGE	: well		
PERMEABILITY	: moderate	No slow permeable layer(s) cm	
FLOODING	Frequency :	Run off : rapid	
MOISTURE CONDITIONS PROFILE	: 0 - 140 cm dry		

VEGETATION Type : semi deciduous woodland

ADDITIONAL REMARKS :

The thickness of the solum (A+B) varies within the pit from about 25 cm to 50 cm. The shallow soil classifies as chromic Cambisol (eutropept), the deeper soils as ferric Cambisol (rhodustalf).

The landscape is strongly sloping with maximum slopes of 30 to 40%. At a distance, break of slopes and in gullies rock outcrops. Soil has still some moisture left, but general feeling of dry soil (irrespect of the rain of the last days). C horizons have a multicoloured (weathering colours) appearance. Most brown/reddish colours in the upper C horizons, becoming yellowish in the deeper C horizons.

BC show clearly the rock structure, although a substancial part of the rock has been transformed in clay.

CLIMATE :	Köppen: Aw"														
Station: RIVAS	11 26 N / 85 59 W			70 m a.s.l			30 km ESE of site			Relevance: good					
Station: NANDAIME	11 45 N / 86 3 W			95 m a.s.l			30 km NNE of site			Relevance: good					
	No. years of record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	
EP Penman	mm	20	132	137	165	172	169	145	148	158	148	139	124	125	1761
relative humidity	%	20	78	74	74	72	77	84	85	80	82	83	82	80	79
precipitation	mm	20	10	5	1	4	179	284	153	180	273	349	82	24	1542
T mean	°C	20	25.8	26.5	27.2	28.0	27.9	27.1	26.8	26.7	26.6	26.2	26.1	25.6	26.7
EP Penman	mm	20	135	134	162	166	167	145	153	151	135	132	125	128	1733
relative humidity	%	23	87	91	119	115	112	91	85	92	97	98	81	78	1146
relative humidity	%	20	76	75	76	76	79	84	83	84	87	86	82	79	81
precipitation	mm	20	10	3	3	16	171	269	137	146	319	313	80	27	1497
T mean	°C	20	26.3	26.5	27.3	28.1	28.2	27.0	26.9	26.8	26.5	26.2	26.1	26.3	26.9

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PROFILE DESCRIPTION :

- Ah 0 - 15 cm. 7.5YR 4.0/5.0, moist clay loam; moderate fine subangular blocky structure; slightly sticky, slightly plastic, friable, slightly hard; many very fine to fine interstitial pores; many very fine to coarse roots throughout; clear smooth boundary to
- Bt 15 - 40 cm. 5.0YR 4.0/6.0, moist clay; strong fine to medium subangular blocky structure; sticky, plastic, firm, hard; broken thin clay cutans; common very fine to fine tubular pores; many fine roots throughout and common medium roots throughout; clear smooth boundary to
- BC 40 - 75 cm. slightly gravelly clay loam; slightly sticky, slightly plastic; many fine roots throughout and few medium roots throughout; diffuse smooth boundary to
- CB 75 - 105 cm. gravelly sandy loam; slightly sticky, slightly plastic; common very fine to fine interstitial pores; many fine roots throughout and few medium roots throughout; gradual smooth boundary to
- C 105 - 145 cm. gravelly loamy sand; non sticky, non plastic; common very fine to fine interstitial pores; few fine roots throughout and few medium roots throughout;

ANALYTICAL DATA :

Hor. no.	Top - Bot mm	>2 mm	2000			1000			500			250			100			TOT 50 SAND	TOT 20 2 SILT	<2 μm	pF-----						
			1000	500	250	100	50	SAND	20	2	SILT	μm	0.0	1.0	1.5	2.0	2.3	2.7	3.4	4.2							
1	0 - 15	-	1	2	3	9	7	20	8	28	36	44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	15 - 40	-	1	1	2	7	5	15	10	24	34	51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	40 - 75	-	1	1	2	3	3	10	19	29	47	43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	75 - 105	-	3	5	4	7	4	23	13	25	38	39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	105 - 145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Hor. no.	pH-	CaCO ₃	ORG-C	MAT-N	EXCH-Ca	CAT-Na	EXCH-H ₊	AC-Al	CEC	ECEC	BASE-SAT	AL-SAT	EC-2.5	mS/cm					
	H ₂ O																		
1	6.8	5.4	1.2	2.35	-	22.8	5.2	0.9	0.1	29.0	-	-	29.4	67	8.2	29.0	99	-	0.16
2	6.3	4.4	-	0.75	-	18.0	7.0	0.3	0.2	25.5	-	-	29.9	58	2.6	25.5	85	-	0.06
3	6.1	4.2	-	0.32	-	17.2	9.9	0.2	0.2	27.5	-	-	25.4	59	1.1	27.5	108	-	0.07
4	5.8	3.9	-	0.18	-	12.2	9.5	0.2	0.4	22.3	-	-	23.1	60	0.6	22.3	97	-	0.03
5	5.6	3.5	-	0.12	-	19.4	14.2	0.3	0.5	34.4	-	-	39.4	-	0.4	34.4	87	-	0.03

remarks (hor. 1 - 5): P-Olsen= -1

CLAY MINERALOGY (1 very weak..., 8 very strong) / EXTRACTABLE Fe Al Si Mn (by AMM. OXALATE(o), Na DITHIONITE(d) & PYROPHO(p))

Hor.

no. MI VE CH SM KA HA ML QU FE GI GO HE Fe(o) Al(o) Si(o) Fe(d) Al(d) Fe(p) Al(p) Pret pHNaF

1	-	-	-	4	6	-	-	3	-	-	-	0.29	0.20	0.04	-	-	-	-	-	-
2	-	-	-	4	6	-	-	3	-	-	-	0.31	0.19	0.04	-	-	-	-	-	-
3	-	-	-	5	6	-	-	3	-	-	-	0.27	0.16	0.04	-	-	-	-	-	-
4	-	-	-	5	6	-	-	2	-	-	-	0.16	0.12	0.03	-	-	-	-	-	-
5	-	-	-	6	4	-	-	4	-	-	-	0.13	0.14	0.04	-	-	-	-	-	-

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Print date (dd/mm/yy) : 04/06/94

FAO/UNESCO (1988)	: Vitric Andosol	(1974 : Vitric Andosol)												
USDA/SCS SOIL TAXONOMY (1992)	: Mollic Ustivitrand, ashy, halloysitic, isohyperthermic	(1975 : mollic vitrandept)												
DIAGNOSTIC CRITERIA														
	FAO (1988)	: Diagnostic horizons : mollic A												
	USDA/SCS (1992)	: Diagnostic properties : andic properties : Diagnostic horizons : mollic epipedon : Diagnostic properties : andic soil properties : Soil moisture regime : ustic												
LOCATION	: National Parc "Volcan Masaya", road to laguna, about halfway													
AUTHOR(S)	Latitude : 11°58' 0'' N Longitude : 86° 8' 0'' W	Altitude : 250 (m.a.s.l.) Date (mm.yy) : 11.92												
GENERAL LANDFORM	: caldera													
PHYSIOGRAPHIC UNIT	: Pacific Volcanic Cordillera													
SLOPE	Gradient : 15%	Topography : rolling												
POSITION OF SITE	: middle slope													
MICRO RELIEF	Kind : level	Aspect : W												
SURFACE CHAR.	Rock outcrop : nil Cracking : nil Salt : nil	Pattern : none Stoniness : nil Slaking/crusting : nil Alkali : nil												
SLOPE PROCESSES	Soil erosion : nil													
	Aggradation : nil													
PARENT MATERIAL	1 : volcanic ejecta													
	Texture : gravelly	derived from : unconsol. pyroclastic rocks												
	Weathering degree : slight	Resistance : low												
Depth lithological boundary (cm):	30													
Remarks	: Origin about 1770													
EFFECTIVE SOIL DEPTH(cm)	: 30													
WATER TABLE	Depth(cm) :	Kind : no watertable observed												
DRAINAGE	: (somewhat) excessive													
PERMEABILITY	: high	No slow permeable layer(s) cm												
FLOODING	Frequency : nil	Run off : medium												
MOISTURE CONDITIONS PROFILE	: 0 - 30 cm moist													
VEGETATION	Type : semi deciduous forest	Status : primary												
Landuse/vegetation remarks	: Ultimate phase prim. vegetation success.													
ADDITIONAL REMARKS :														
Shallow, young, (somewhat) excessively drained, black loamy sand soil developed from volcanic ejecta, derived from unconsolidated pyroclastic rock (ash, lapilli, volcanic bombs). The soil contains fresh pyroclastic fragments, is weakly structured, highly porous and highly erodable. At the surface an accumulation of about 2 cm of organic material is found. The densely closed natural vegetation prevents soil erosion. The profile forms part of the NIC05 to NIC09 toposequence.														
CLIMATE :	Köppen: Aw"													
Station: MASAYA	15 59 N / 86 6 W	235 m a.s.l												
		2 km E of site												
		Relevance: very good												
	No. years of record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
EP Penman	mm	172	194	243	234	202	147	145	150	128	135	134	144	1923
relative humidity	%	71	67	64	61	67	80	81	81	82	82	80	75	74
precipitation	mm	7	4	4	7	174	212	186	209	244	255	62	15	1295
T mean	°C	25.0	25.9	27.0	27.9	28.1	26.5	26.0	26.4	26.0	25.8	25.5	25.0	26.3
T max	°C	30.0	31.3	32.8	33.7	33.1	30.7	30.0	30.4	30.4	30.2	30.0	29.8	31.1
T min	°C	20.0	20.6	21.2	22.2	23.1	22.4	22.1	22.3	21.7	21.6	21.1	20.2	21.6

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PROFILE DESCRIPTION :

Ah 0 - 10 cm. black (10YR 2.0/1.0, moist) loamy sand; leaves, moderately decomposed; weak fine to medium granular structure; very friable, soft; many fine continuous exped tubular pores and many medium random continuous exped tubular pores; highly porous; many very fine to coarse roots throughout; frequent fine fresh pyroclastic fragments and few medium fresh pyroclastic fragments; clear smooth boundary to

AC 10 - 30 cm. very dark grayish brown (10YR 3.0/2.0, moist) loamy sand; weakly coherent structure; loose; many fine continuous exped tubular pores; highly porous; common fine roots throughout and common medium roots throughout; frequent fine fresh pyroclastic fragments and few medium fresh pyroclastic fragments; abrupt wavy boundary to

R 30 - cm. ;

ANALYTICAL DATA :

Hor. no.	Top - Bot mm	>2		2000	1000	500	250	100	TOT	50	20	TOT	<2	DISP	BULK	pF-	---					
		mm	1000	500	250	100	50	SAND	20	2	SILT	μm	DENS	0.0	1.0	1.5	2.0	2.3	2.7	3.4	4.2	
1	0 - 10	-	34	22	9	11	4	79	9	6	15	6	7.0	0.90	55	39	36	27	23	20	12	11
2	10 - 30	-	29	27	11	10	5	82	6	6	13	6	3.0	0.94	48	25	22	15	13	11	7	7
Hor. no.	pH- H ₂ O	-- CaCO ₃ KCl	ORG- C	MAT. %	EXCH Ca %	CAT. N %	---	---	---	---	---	---	EXCH H+Al cmol(+)/kg	AC. Al %	CEC soil clay OrgC ECEC	---	---	---	---	BASE SAT %	Al SAT %	EC mS/cm
1	6.3	5.6	0.0	3.07	0.36	12.4	1.7	0.5	0.0	14.6	-	-	18.0	281	10.7	14.6	-	81	-	0.00		
2	6.5	5.7	1.3	2.42	0.24	12.7	1.7	0.4	0.0	14.8	-	-	17.0	309	8.5	14.8	-	87	-	0.05		

remarks (hor. 1) : P-Olsen= 2
 remarks (hor. 2) : P-Olsen= 1

CLAY MINERALOGY (1 very weak..., 8 very strong) / EXTRACTABLE Fe Al Si Mn (by AMM. OXALATE(o), Na DITHIONITE(d) & PYROPHO(p)

Hor.

no. MI VE CH SM KA HA ML QU FE GI GO HE Fe(o) Al(o) Si(o) Fe(d) Al(d) Fe(p) Al(p) Pret pHNaF

1	-	-	-	-	-	1	-	-	-	-	1.23	0.79	0.50	-	-	-	-	-	-	-	-
2	-	-	-	-	-	1	-	-	-	-	1.25	0.86	0.51	-	-	-	-	-	-	-	-

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ISIS 4.0 data sheet of monolith NI006

Country : NICARAGUA

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Print date (dd/mm/yy) : 04/06/94

FAO/UNESCO (1988)	:	Mollie Andosol	(1974 : Mollie Andosol)											
USDA/SCS SOIL TAXONOMY (1992)	:	Typic Haplustand, loamy, halloysitic, isohyperthermic	(1975 : typic eutrandept)											
LOCAL CLASSIFICATION	:	Series "Nindiri"												
DIAGNOSTIC CRITERIA	FAO (1988)	Diagnostic horizons : mollie A, cambic B												
	USDA/SCS (1992)	Diagnostic horizons : mollie epipedon, cambic horizon												
		Soil moisture regime : ustic												
LOCATION	:	Cooperative "J.Arias Lopez", Altos Sur de Masaya, 200m farm St. Juana												
AUTHOR(S)	Latitude :	12° 21' 30" N	Longitude : 86° 7' 0" W											
			Altitude : 190 (m.a.s.l.)											
			Date (mm.yy) : 11.92											
GENERAL LANDFORM	:	piedmont	Topography : flat or almost flat											
PHYSIOGRAPHIC UNIT	:	Pacific Volcanic Cordillera												
SLOPE	Gradient :	2%	Aspect : NNE											
POSITION OF SITE	:	lower slope	Form : straight											
MICRO RELIEF	Kind :	level												
SURFACE CHAR.	Rock outcrop :	nil	Stoniness : nil											
	Cracking :	nil	Slaking/crusting : nil											
	Salt :	nil	Alkali : nil											
SLOPE PROCESSES	Soil erosion :	slight sheet	Aggradation : nil											
	Slope stability :	stable												
PARENT MATERIAL	1 :	volcanic ejecta	derived from : unconsol. pyroclastic rocks											
	Texture :	sandy												
	Weathering degree :	slight												
Depth lithological boundary (cm):	115		Resistance : moderate											
Remarks	:													
EFFECTIVE SOIL DEPTH(cm)	:	115												
WATER TABLE	Depth(cm) :		Kind : no watertable observed											
DRAINAGE	:	well												
PERMEABILITY	:	slow	Slow permeable layer from : 115 to 0 cm											
FLOODING	Frequency :	nil	Run off : very slow											
MOISTURE CONDITIONS PROFILE	:	0 - 115 cm moist												
LAND USE	:	cultivated pasture; no irrigation; Rotation : crop - grass rotation, lay												
Landuse/vegetation remarks	:	In the past used for maize and root crop												
ADDITIONAL REMARKS :														
Deep, well drained, black to dark brown loamy to sandy loam soil developed from volcanic ejecta, derived from unconsolidated pyroclastic materials (ash, lapilli). The soil contains few manganiferous concretions, is friable, moderately structured and highly porous and permeable. A recent profile (A-Bw-C) is found upon a buried profile (2Ab-2Bb-R) derived from older pyroclastic materials. The profile forms part of the NIC05 to NIC09 toposequence.														
CLIMATE :	Köppen: Aw"													
Station: MASAYA	15 59 N / 86 6 W	235 m a.s.l	9 km S of site	Relevance: very good										
	No. years of record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
EP Penman	mm	172	194	243	234	202	147	145	150	128	135	134	144	1923
relative humidity	%	71	67	64	61	67	80	81	81	82	82	80	75	74
precipitation	mm	7	4	4	7	174	212	186	209	244	255	62	15	1295
T mean	°C	25.0	25.9	27.0	27.9	28.1	26.5	26.0	26.4	26.0	25.8	25.5	25.0	26.3
T max	°C	30.0	31.3	32.8	33.7	33.1	30.7	30.0	30.4	30.4	30.2	30.0	29.8	31.1
T min	°C	20.0	20.6	21.2	22.2	23.1	22.4	22.1	22.3	21.7	21.6	21.1	20.2	21.6

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PROFILE DESCRIPTION :

- A11 0 - 12 cm. black (10YR 2.0/1.0, moist) loam; moderate medium granular structure;, friable; few medium distinct clear mottles (10YR 4.0/4.0); many fine continuous inped pores; highly porous; many fine roots; few spherical manganiferous concretions; clear smooth boundary to
- A12 12 - 33 cm. black (10YR 2.0/1.0, moist) loam; moderate medium granular structure;, friable; few fine continuous inped pores and few very fine random continuous inped pores; highly porous; few fine roots and few very fine roots; few irregular hard manganiferous concretions; clear smooth boundary to
- Bw 33 - 55 cm. dark brown (7.5YR 3.0/2.0, moist) loam; moderate medium to coarse subangular blocky structure;, friable; few fine continuous inped pores and few very fine random continuous inped pores; highly porous; few fine roots and few very fine roots; few irregular hard manganiferous concretions; few termite channels; abrupt smooth boundary to
- C 55 - 78 cm. dark brown (7.5YR 3.0/4.0, moist) sandy loam; weak medium angular blocky structure;, loose; many fine continuous inped pores and many medium continuous inped pores; many fine roots and many medium roots; frequent irregular hard manganiferous inclusions; frequent fine fresh pyroclastic fragments; clear wavy boundary to
- 2Ab 78 - 104 cm. dark brown (7.5YR 3.0/4.0, moist) clay loam; moderate coarse angular blocky structure;, friable; many fine continuous inped pores and many medium continuous inped pores; many fine roots and many medium roots; few irregular manganiferous concretions; frequent mycelium and termite channels; clear wavy boundary to
- 2Bb 104 - 115 cm. dark brown (7.5YR 3.0/2.0, moist) silty clay loam; moderate coarse angular blocky structure;, firm ; many coarse pores and many medium pores; many fine roots and many medium roots; few spherical manganiferous concretions; abrupt wavy boundary to
- R 115 - cm. ;

ANALYTICAL DATA :

Hor. no.	Top - Bot	>2 mm	2000	1000	500	250	100	TOT 50	SAND 20	TOT 2	<2 μm SILT	DISP	BULK DENS	pF-0.0	-1.0	-1.5	-2.0	-2.3	-2.7	-3.4	-4.2
			1000	500	250	100	50	SAND	20	2	SILT	μm									
1	0 - 12	-	4	6	10	18	7	45	23	15	38	18	10.0	-	-	-	-	-	-	-	-
2	12 - 33	-	3	5	11	20	10	49	14	22	36	15	7.0	0.82	64	60	58	46	41	38	28
3	33 - 55	-	3	6	10	18	7	44	16	23	40	16	8.0	0.69	68	65	62	50	43	40	36
4	55 - 78	-	12	11	10	16	8	56	14	19	33	11	5.0	0.70	61	56	53	44	40	37	28
5	78 - 104	-	2	2	4	12	5	26	11	34	45	29	13.0	-	-	-	-	-	-	-	-
6	104 - 115	-	0	1	2	8	8	19	11	43	54	27	14.0	-	-	-	-	-	-	-	-

Hor. no.	pH-	-- CaCO ₃	ORG- H ₂ O	MAT- KCl	EXCH C %	CAT. N %	Ca %	Mg %	K %	Na sum	EXCH H+Al cmol(+) / kg	AC. Al	CEC soil	--- clay	BASE ECEC %	Al SAT %	EC SAT %	2.5 mS/cm	
1	6.8	5.5	2.2	2.18	0.19	27.3	7.5	3.0	0.3	38.1	-	-	42.6	242	7.6	38.1	89	-	0.06
2	6.8	5.4	2.1	2.47	0.22	23.5	6.2	4.0	0.2	33.9	-	-	37.5	248	8.6	33.9	90	-	0.06
3	6.8	5.5	2.3	2.26	0.19	24.1	6.4	5.4	0.2	36.1	-	-	39.9	246	7.9	36.1	90	-	0.06
4	7.2	5.7	2.2	0.89	0.08	29.6	7.6	0.8	0.6	38.6	-	-	39.3	357	3.1	38.6	98	-	0.05
5	7.4	5.9	3.2	1.31	0.09	40.9	18.1	0.2	0.9	60.1	-	-	58.0	202	4.6	60.1	104	-	0.06
6	7.4	5.9	3.8	2.25	0.16	49.6	38.6	0.1	0.9	89.2	-	-	58.3	216	7.9	89.2	153	-	0.06

remarks (hor. 1) : P-Olsen= 8

remarks (hor. 2) : P-Olsen= 11

remarks (hor. 3) : P-Olsen= 3

remarks (hor. 4 - 5) : P-Olsen= 1

remarks (hor. 6) : P-Olsen= 0

CLAY MINERALOGY (1 very weak, ..., 8 very strong) / EXTRACTABLE Fe Al Si Mn (by AMM. OXALATE(o), Na DITHIONITE(d) & PYROPHO(p))

Hor.

no. MI VE CH SM KA HA ML QU FE GI GO HE Fe(o) Al(o) Si(o) Fe(d) Al(d) Fe(p) Al(p) Pret pHNaF

1	-	-	-	-	-	4	-	-	-	-	3.45	1.31	0.79	-	-	-	-	-	-
2	-	-	-	-	-	3	-	-	-	-	3.32	1.18	0.73	-	-	-	-	-	-
3	-	-	-	-	-	5	-	-	-	-	3.84	1.43	0.93	-	-	-	-	-	-
4	-	-	-	-	-	5	-	-	-	-	4.34	1.40	0.84	-	-	-	-	-	-
5	-	-	-	-	-	5	-	-	-	-	4.05	1.50	1.07	-	-	-	-	-	-
6	-	-	-	-	-	4	-	-	-	-	5.50	3.07	1.88	-	-	-	-	-	-

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FAO/UNESCO (1988) (1974)	: Haplic Phaeozem, duripan phase													
USDA/SCS SOIL TAXONOMY (1992)	: Entic Durustoll, fine silty, mixed, isohyperthermic LOCAL CLASSIFICATION : Series "Zambrano"													
	(1975 : durustoll)													
DIAGNOSTIC CRITERIA	FAO (1988) USDA/SCS (1992)													
	: Diagnostic horizons : mollic A : Diagnostic horizons : mollic epipedon, duripan : Soil moisture regime : ustic													
LOCATION	: Finca "El Plantel", Km 42 Road Masaya-Tipitapa; 100 m south of source													
AUTHOR(S)	Latitude : 12° 6' 0" N Longitude : 86° 5' 0" W Vogel, Rodriguez													
	Altitude : 130 (m.a.s.l.) Date (mm.yy) : 11.92													
GENERAL LANDFORM	: piedmont													
PHYSIOGRAPHIC UNIT	: Pacific Volcanic Province													
SLOPE	Gradient : 2%													
POSITION OF SITE	: middle slope													
MICRO RELIEF	Kind : ripples													
SURFACE CHAR.	Rock outcrop : nil Form : angular blocky Cracking : nil Salt : nil													
SLOPE PROCESSES	Soil erosion : slight rill Slope stability : stable													
	Topography : undulating Aspect : WNW Pattern : linear Stoniness : fairly stony Av.Size (cm) : 1 Slaking/crusting : nil Alkali : nil Aggradation : nil													
PARENT MATERIAL	1 : volcanic ejecta Texture : silty													
	derived from : tuff													
	Weathering degree : partial or moderate													
Depth lithological boundary (cm): 66	Resistance : moderate													
Remarks	:													
EFFECTIVE SOIL DEPTH(cm)	: 66													
WATER TABLE	Depth(cm) :													
DRAINAGE	: well													
PERMEABILITY	:													
FLOODING	Frequency : nil													
MOISTURE CONDITIONS PROFILE	: 43 - 66 cm dry 0 - 43 cm moist													
LAND USE	: medium level arable farming; Crops : sorghum; no irrigation; Rotation : crop rotation continuous													
Landuse/vegetation remarks	: Actual landuse threatened by erosion													
ADDITIONAL REMARKS :	Moderately deep, (moderately) well drained, very dark brown to brown silty clay loam to silty loam soil developed from volcanic ejecta, derived from tuff. The soil contains fresh pyroclastic and talpetate fragments, is moderately structured and permeable and highly porous. The profile consists of three different horizon sequences separated by two thin cemented layers, in Nicaragua called "talpetate" (Bm horizon). In this part of Nicaragua the talpetate is probably of geogenetic origin (Bm horizon becomes C horizon). Due to the high erosion hazard, the area urgently needs some soil conservation measures, because otherwise the talpetate layer will outcrop at the surface and the soil will loose its agricultural potential. The profile forms part of the NIC05 to NIC09 toposequence.													
CLIMATE :	Köppen: Aw"													
Station: MASAYA	15 59 N / 86 6 W													
	235 m a.s.l													
	20 km S of site													
	Relevance: good													
	No. years of record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
EP Penman	mm	172	194	243	234	202	147	145	150	128	135	134	144	1923
relative humidity	%	71	67	64	61	67	80	81	81	82	82	80	75	74
precipitation	mm	7	4	4	7	174	212	186	209	244	255	62	15	1295
T mean	°C	25.0	25.9	27.0	27.9	28.1	26.5	26.0	26.4	26.0	25.8	25.5	25.0	26.3
T max	°C	30.0	31.3	32.8	33.7	33.1	30.7	30.0	30.4	30.4	30.2	30.0	29.8	31.1
T min	°C	20.0	20.6	21.2	22.2	23.1	22.4	22.1	22.3	21.7	21.6	21.1	20.2	21.6

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PROFILE DESCRIPTION :

Ap	0 - 15 cm.	very dark brown (10YR 2.0/2.0, moist)dark grayish brown (10YR 4.0/2.0, dry) slightly gravelly silty clay loam; moderate medium subangular blocky to moderate medium wedge-shaped ang.bl. structure; hard; few very fine pores; highly porous; many fine roots throughout and many medium roots throughout; few fine fresh pyroclastic fragments and very few medium fresh talpetate fragments; abrupt smooth boundary to
Bw	15 - 43 cm.	dark brown (10YR 4.0/3.0, moist)yellowish brown (10YR 5.0/6.0, dry) slightly gravelly loam; weak to moderate medium subangular blocky to weak to moderate medium wedge-shaped ang.bl. structure; , slightly hard; many medium pores and few medium pores; highly porous; few fine roots throughout; very few medium fresh talpetate fragments; abrupt smooth boundary to
Bm	43 - 46 cm.	light olive brown (2.5Y 5.0/4.0, moist)yellow (2.5Y 7.0/6.0, dry); strongly cemented broken platy duripan; abrupt smooth boundary to
2Bb	46 - 57 cm.	dark yellowish brown (10YR 3.0/4.0, moist)dark yellowish brown (10YR 4.0/4.0, dry) gravelly silt loam; weak medium subangular blocky structure; , slightly hard; many medium pores; highly porous; few very fine roots throughout; frequent fine fresh pyroclastic fragments and frequent fine fresh talpetate fragments; abrupt smooth boundary to
2Bm	57 - 60 cm.	light olive brown (2.5Y 5.0/4.0, moist)yellow (2.5Y 7.0/6.0, dry); strongly cemented broken platy duripan; abrupt smooth boundary to
3Bb	60 - 66 cm.	dark brown (10YR 3.0/3.0, moist)brown (10YR 5.0/3.0, dry) silt loam; weak medium subangular blocky structure; , slightly hard; many medium pores; highly porous; few very fine roots throughout ; frequent fine fresh pyroclastic fragments and frequent fine fresh talpetate fragments; abrupt smooth boundary to
R	66 - cm.	;

ANALYTICAL DATA :

Hor. no.	Top - Bot	>2 mm	2000	1000	500	250	100	50	TOT SAND	20	TOT 2 SILT	<2 μm	DISP	BULK DENS	pF-	---	---	---	---	---	
															1.0	1.5	2.0	2.3	2.7	3.4	4.2
1	0 - 15	-	2	2	2	3	2	11	9 40	49	40	20.0	1.01	59	59	58	50	47	44	38	36
2	15 - 43	-	5	5	4	6	4	24	10 39	49	27	8.0	0.80	66	65	63	57	52	48	37	33
3	46 - 57	-	4	5	4	7	4	23	16 45	61	16	10.0	0.83	66	64	62	55	50	46	35	32
4	60 - 66	-	5	7	6	10	7	34	18 36	54	12	8.0	-	-	-	-	-	-	-	-	-
5	66 - 66	-	5	7	5	7	8	32	21 38	59	9	7.0	-	-	-	-	-	-	-	-	-

Hor. no.	pH-H ₂ O	-- CaCO ₃	ORG-C	MAT-N	EXCH Ca	CAT-Mg	----- EXCH K	CEC sum H+Al	--- Al soil clay	--- OrgC ECEC	--- BASE SAT	AL SAT	EC 2.5						
	%	%	%	%	cmol(+) / kg	----- ---	cmol(+) / kg	----- ---	----- ---	----- ---	%	%	mS/cm						
1	7.1	5.5	2.2	2.21	0.23	38.0	15.8	2.3	0.1	56.2	-	-	53.3	133	7.7	56.2	105	-	0.06
2	7.6	5.8	2.4	1.22	0.12	38.9	15.5	0.6	0.3	55.3	-	-	58.1	218	4.3	55.3	95	-	0.06
3	7.7	5.7	2.6	0.70	0.09	36.7	22.7	0.9	0.4	60.7	-	-	64.2	399	2.5	60.7	95	-	0.07
4	7.8	5.7	2.7	0.42	0.06	36.6	18.8	0.6	0.5	56.5	-	-	60.2	489	1.5	56.5	94	-	0.05
5	7.9	5.7	2.6	0.19	0.03	31.8	14.5	0.3	0.7	47.3	-	-	42.9	488	0.7	47.3	110	-	0.04

remarks (hor. 1) : P-Olsen= 8

remarks (hor. 2 - 3): P-Olsen= 2

remarks (hor. 4) : P-Olsen= 1

remarks (hor. 5) : P-Olsen= 0

CLAY MINERALOGY (1 very weak,..., 8 very strong) / EXTRACTABLE Fe Al Si Mn (by AMM. OXALATE(o), Na DITHIONITE(d) & PYROPHO(p))

Hor.

no. MI VE CH SM KA HA ML QU FE GI GO HE Fe(o) Al(o) Si(o) Fe(d) Al(d) Fe(p) Al(p) Pret pHNaF

1	-	-	-	-	-	4	-	-	-	-	1.69	0.69	0.39	-	-	-	-	-	-
2	-	-	-	-	-	5	-	-	-	-	1.80	0.80	0.41	-	-	-	-	-	-
3	-	-	-	-	-	5	-	-	-	-	2.11	0.78	0.36	-	-	-	-	-	-
4	-	-	-	-	-	6	-	-	-	-	1.63	0.61	0.33	-	-	-	-	-	-
5	-	-	-	-	-	6	-	-	-	-	1.17	0.53	0.29	-	-	-	-	-	-

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FAO/UNESCO (1988)	: Orthi-Chromic Luvisol	(1974 : Chromic Luvisol)
USDA/SCS SOIL TAXONOMY (1992)	: Typic Rhodustalf, fine, mixed, isohyperthermic	(1975 : typic rhodustalf)
DIAGNOSTIC CRITERIA	FAO (1988) USDA/SCS (1992)	: Diagnostic horizons : ochric A, argic B : Soil moisture regime : ustic
LOCATION	: Main road to "Ingenio Victoria de Julio", 2 Km westwards of sugar mill	
AUTHOR(S)	Latitude : 12°15' 0" N : Vogel, Rodriguez	Longitude : 86° 0' 0" W Altitude : 80 (m.a.s.l.) Date (mm.yy) : 11.92
GENERAL LANDFORM	: plain	Topography : flat or almost flat
PHYSIOGRAPHIC UNIT	: Nicaragua Depression	
SLOPE	Gradient : -%	Aspect : S
POSITION OF SITE	: flat	Form : straight
MICRO RELIEF	Kind : ripples	Pattern : linear
SURFACE CHAR.	Rock outcrop : little rocky Form : angular irregular Cracking : nil Salt : nil	Stoniness : Av.Size (cm) : 2 Slaking/crusting : nil Alkali : nil
SLOPE PROCESSES	Soil erosion : nil Slope stability : stable	Aggradation : nil
PARENT MATERIAL	1 : alluvium Texture : silty Weathering degree : slight	derived from : pyroclastic, consolidated
PARENT MATERIAL	2 : Texture : gravelly Weathering degree :	Resistance : low Derived from :
Depth lithological boundary (cm):	116	Resistance :
Remarks	:	
EFFECTIVE SOIL DEPTH(cm)	: 116	
WATER TABLE	Depth(cm) :	Kind : no watertable observed
DRAINAGE	: well	
PERMEABILITY	: slow	Slow permeable layer from : 116 to 0 cm
FLOODING	Frequency : nil	Run off : ponded
MOISTURE CONDITIONS PROFILE	: 0 - 116 cm moist	
LAND USE	: high level arable farming; Crops : sugar cane; seasonal irrigated; Rotation : monocultur	
Landuse/vegetation remarks	: Profile at border sugar cane field	

ADDITIONAL REMARKS :

Deep, well drained, (dark) reddish brown clay to silty clay soil developed from alluvium, derived from consolidated pyroclastic materials. The soil contains few pyroclastic fragments, is friable, strongly to moderately structured, moderately to slowly permeable and moderately porous. This well developed soil shows differentiation in color and texture (illuvial Bt horizon). The profile forms part of the NIC05 to NIC09 toposequence. NIC08 ("red soils") and NIC09 ("black soils") are both found at short distances in an irregular pattern, in consequence of differences in drainage conditions (well c.q. imperfectly drained).

CLIMATE : Köppen: Aw
Station: MANAGUA 12° 7' N/ 86° 11' W 40 m a.s.l 35 km WSW of site Relevance: moderate

	No. years of record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
EP Penman mm		138	147	181	181	176	136	146	148	133	119	118	123	1746
precipitation mm		3	1	3	11	147	211	136	110	216	292	44	10	1184
tot.glob.rad. MJ/m ²		17.4	20.5	21.8	22.7	22.2	19.2	19.9	20.5	19.9	16.0	17.2	15.9	0.0
T mean °C		26.3	27.2	28.6	29.3	29.4	27.2	26.9	27.2	26.9	26.5	26.3	26.1	27.3
T max °C		31.6	33.0	34.6	35.2	34.7	31.4	31.1	31.7	31.5	30.9	31.2	31.5	32.4
T min °C		21.0	21.5	22.7	23.5	24.1	23.0	22.8	22.7	22.4	22.2	21.5	20.7	22.3
windspeed(at 2m) m/s		3.1	3.4	3.3	2.9	2.2	2.5	2.4	1.9	1.6	2.0	2.5	2.6	2.6
bright sunshine %		65	75	73	73	70	53	57	60	59	47	60	57	62

PROFILE DESCRIPTION :

A 0 - 15 cm. 5.0YR 3.0/2.0, moist clay; strong fine to medium granular and moderate fine to medium subangular blocky structure;, firm; common medium continuous tubular pores and common fine random tubular pores; moderately porous; many fine roots between pedes and many medium roots between pedes; few fine weathered pyroclastic fragments; clear smooth boundary to

AB 15 - 33 cm. 5.0YR 3.0/2.0, moist clay; strong medium subangular blocky to strong medium to coarse prismatic structure;, firm; common fine continuous pores; moderately porous; many fine roots between pedes; very few small spherical soft manganiferous concretions; few fine weathered pyroclastic fragments; abrupt wavy boundary to

Bt 33 - 52 cm. reddish brown (2.5YR 4.0/4.0, moist) clay; moderate medium subangular blocky to moderate medium to coarse prismatic structure;, friable; common fine continuous tubular pores; common fine roots between pedes; very few small spherical soft manganiferous concretions; frequent medium weathered pyroclastic fragments; few krotovinas; clear wavy boundary to

BC 52 - 75 cm. 5.0YR 4.0/5.0, moist silty clay; moderate medium wedge-shaped ang.bl. structure;, friable; common fine continuous tubular pores; few fine roots between pedes; frequent medium weathered pyroclastic fragments; abrupt wavy boundary to

C 75 - 116 cm. dark yellowish brown (10YR 3.5/6.0, moist) silt loam; weak to moderate medium wedge-shaped ang.bl. structure;, friable; common very fine continuous tubular pores; few fine roots between pedes; very few medium weathered pyroclastic fragments; abrupt smooth boundary to

R 116 - cm. light yellowish brown (10YR 6.0/4.0, moist);

ANALYTICAL DATA :

Hor.	Top - Bot	>2 mm	2000	1000	500	250	100	TOT 50	20	TOT <2 μm	DISP	BULK DENS	pF 0.0	---	---	---	---	---	---	---
no.		mm	1000	500	250	100	50	SAND	20	SILT	μm		0.0	1.0	1.5	2.0	2.3	2.7	3.4	4.2
1	0 - 15	-	1	1	1	2	2	7	6	28	34	59	36.0	-	-	-	-	-	-	-
2	15 - 33	-	1	1	1	1	1	6	4	30	34	61	34.0	0.97	57	48	47	43	40	38
3	33 - 52	-	0	0	1	1	1	3	5	24	29	68	35.0	0.99	59	51	49	44	43	41
4	52 - 75	-	1	1	2	4	3	10	12	37	49	41	20.0	0.97	58	55	53	50	48	45
5	75 - 116	-	2	2	3	8	6	20	15	40	56	25	12.0	-	-	-	-	-	-	-

Hor.	pH-H ₂ O	-- CaCO ₃ H ₂ O	ORG-C	MAT-N	EXCH Ca	CAT-Mg	-----	EXCH K	AC-Na	CEC sum	H+Al	Al	soil clay	OrgC	--- ECEC	BASE SAT	Al SAT	EC 2.5	
no.	%	%	%	%	%	%	-----	%	cmol(+)/kg	-----	-----	-----	-----	-----	%	%	mS/cm		
1	6.4	4.9	0.0	2.98	0.24	25.3	20.6	3.0	0.1	49.0	-	-	44.0	74	10.4	49.0	111	-	0.06
2	6.4	4.8	0.0	2.21	0.20	26.1	21.2	1.0	0.2	48.5	-	-	42.7	71	7.7	48.5	114	-	0.04
3	6.3	4.6	0.0	1.36	0.14	23.0	22.5	0.5	0.2	46.2	-	-	47.6	70	4.8	46.2	97	-	0.05
4	6.0	4.2	0.0	0.88	0.09	18.8	17.0	0.2	0.2	36.2	-	-	41.8	101	3.1	36.2	87	-	0.05
5	6.1	4.1	0.0	0.62	0.06	18.9	18.4	0.4	0.3	38.0	-	-	44.2	180	2.2	38.0	86	-	0.03

remarks (hor. 1) : P-Olsen= 5

remarks (hor. 2) : P-Olsen= 2

remarks (hor. 3 - 5): P-Olsen= 0

CLAY MINERALOGY (1 very weak..., 8 very strong) / EXTRACTABLE Fe Al Si Mn (by AMM. OXALATE(o), Na DITHIONITE(d) & PYROPHO(p))

Hor.

no. MI VE CH SM KA HA ML QU FE GI GO HE Fe(o) Al(o) Si(o) Fe(d) Al(d) Fe(p) Al(p) Pret pHNaF

1	-	-	-	4	-	5	-	-	-	-	1.02	0.58	0.32	-	-	-	-	-
2	-	-	-	4	-	5	-	-	-	-	1.12	0.55	0.30	-	-	-	-	-
3	-	-	-	4	-	5	-	-	-	-	1.11	0.58	0.19	-	-	-	-	-
4	-	-	-	4	-	5	-	-	-	-	1.39	0.66	0.20	-	-	-	-	-
5	-	-	-	4	-	5	-	-	-	-	1.39	0.62	0.21	-	-	-	-	-

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ISIS 4.0 data sheet of monolith NI009

Country : NICARAGUA

Page : 1

Print date (dd/mm/yy) : 04/06/94

FAO/UNESCO (1988)	: Eutric Vertisol	(1974 : Pellic Vertisol)											
USDA/SCS SOIL TAXONOMY (1992)	: Typic Haplustert, very fine, montmorillonitic(calc.), isohypert(1975 : typic pellustert)												
LOCAL CLASSIFICATION	: Series "San Nicolas"												
DIAGNOSTIC CRITERIA													
FAO (1988)													
: Diagnostic horizons : ochric A, cambic B													
: Diagnostic properties : slickensides													
: Diagnostic horizons : ochric epipedon, cambic horizon													
: Soil moisture regime : ustic													
LOCATION	: Timal, Main road to "Ingenio Victoria de Julio", Km 30, Excavation pit												
AUTHOR(S)	Latitude : 12°15' 0" N	Longitude : 86° 2' 0" W											
	Altitude : 80 (m.a.s.l.)												
	Date (mm.yy) : 11.92												
GENERAL LANDFORM	: plain												
PHYSIOGRAPHIC UNIT	: Nicaragua Depression												
SLOPE	Gradient : -%	Topography : flat or almost flat											
POSITION OF SITE	: flat	Aspect : ESE											
MICRO RELIEF	Kind : gilgai	Form :											
SURFACE CHAR.	Rock outcrop : nil	Pattern : none											
	Cracking : large cracks	Stoniness : nil											
	Salt : nil	Slaking/crusting : nil											
SLOPE PROCESSES	Soil erosion : nil	Alkali : nil											
	Slope stability : stable	Aggradation : nil											
PARENT MATERIAL	1 : alluvium	derived from : tuff											
	Texture : silty												
	Weathering degree : slight	Resistance : moderate											
Depth lithological boundary (cm) :	90												
Remarks	:												
EFFECTIVE SOIL DEPTH(cm)	: 90												
WATER TABLE	Depth(cm) :	Kind : no watertable observed											
DRAINAGE	: imperfectly												
PERMEABILITY	: slow	Slow permeable layer from : 55 to 90 cm											
FLOODING	Frequency : irregular	Run off : ponded											
MOISTURE CONDITIONS PROFILE	: 0 - 90 cm moist												
LAND USE	: semi natural grassland, grazed; no irrigation; Rotation : not relevant												
VEGETATION	Type : medium tall grassland	Status : secondary											
Landuse/vegetation remarks	: Intended to use for sugar cane												
ADDITIONAL REMARKS :													
Moderately deep, imperfectly drained, very dark grey to black heavy clay developed from alluvium derived from tuff. The soil contains few pyroclastic fragments, is moderately to strongly structured (columnar) and moderately to slightly porous. This typical Vertisol with a very high clay content and poor internal drainage shows great problems in workability and management (central pivot irrigation system). This profile forms part of the NIC05 to NIC09 toposequence. NIC09 ("black soils") and NIC08 ("red soils") are both found at short distances in an irregular pattern, as a consequence of differences in drainage conditions (imperfectly c.q. well drained).													
CLIMATE :	Köppen: Aw"												
Station: MANAGUA	12 7 N/ 86 11 W	40 m a.s.l											
		30 km WSW of site											
		Relevance: moderate											
No. years of record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
EP Penman mm	138	147	181	181	176	136	146	148	133	119	118	123	1746
precipitation mm	3	1	3	11	147	211	136	110	216	292	44	10	1184
tot.glob.rad. MJ/m ²	17.4	20.5	21.8	22.7	22.2	19.2	19.9	20.5	19.9	16.0	17.2	15.9	0.0
T mean °C	26.3	27.2	28.6	29.3	29.4	27.2	26.9	27.2	26.9	26.5	26.3	26.1	27.3
T max °C	31.6	33.0	34.6	35.2	34.7	31.4	31.1	31.7	31.5	30.9	31.2	31.5	32.4
T min °C	21.0	21.5	22.7	23.5	24.1	23.0	22.8	22.7	22.4	22.2	21.5	20.7	22.3
windspeed(at 2m) m/s	3.1	3.4	3.3	2.9	2.2	2.5	2.4	1.9	1.6	2.0	2.5	2.6	2.6
bright sunshine %	65	75	73	73	70	53	57	60	59	47	60	57	62

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PROFILE DESCRIPTION :

A	0 - 15 cm.	very dark gray (10YR 3.0/1.0, moist) clay; moderate to strong fine to medium granular and weak to moderate medium wedge-shaped ang.bl. structure; slightly sticky, plastic; few medium distinct clear mottles (7.5YR 4.0/6.0); common fine pores and common very fine oblique pores; moderately porous; common fine roots between pedes and common very fine roots between pedes; very few fine fresh pyroclastic fragments; clear wavy boundary to
Bw	15 - 55 cm.	very dark gray (10YR 3.0/1.0, moist) clay; strong medium columnar structure; slightly sticky, plastic; broken slickensides cutans on pedfaces; few fine pores and few very fine oblique pores; slightly porous; few fine roots between pedes and few very fine roots between pedes; very few fine fresh pyroclastic fragments; clear wavy boundary to
C	55 - 90 cm.	very dark gray (10YR 3.0/1.0, moist) clay; strongly coherent structure; non sticky, very plastic; few fine pores and few very fine oblique pores; slightly porous; few fine roots between pedes;
R	90 - cm.	dark brown (10YR 4.0/3.0, moist) silt loam;;

ANALYTICAL DATA :

Hor. no.	Top - Bot	>2	2000	1000	500	250	100	TOT	50	20	TOT	<2	DISP	BULK	pF-	---	---	---	---	---		
		mm	1000	500	250	100	50	SAND	20	2	SILT	μm	DENS	0.0	1.0	1.5	2.0	2.3	2.7	3.4	4.2	
1	0 - 15	-	1	1	1	1	1	4	1	16	17	79	69.0	1.06	62	61	60	57	57	54	50	46
2	15 - 55	-	0	1	1	1	1	3	1	15	16	81	72.0	1.08	61	60	60	58	57	53	47	38
3	55 - 90	-	0	0	0	1	1	3	1	14	14	83	64.0	1.04	59	59	59	56	55	52	47	37

Hor. no.	pH-	--	CaCO ₃	ORG-	MAT.	EXCH	CAT.	---	---	---	---	---	EXCH	AC.	CEC	---	---	---	BASE	AL	EC	2.5
	H ₂ O	KCl		C	N	Ca	Mg	K	Na	sum	H+Al	Al	soil	clay	OrgC	ECEC	SAT	SAT	%	%	mS/cm	
1	6.4	4.7	0.0	1.11	0.10	48.2	34.8	0.2	0.6	83.8	-	-	77.2	98	3.9	83.8	109	-	0.08			
2	6.5	4.7	0.0	0.86	0.07	43.8	29.0	0.2	0.8	73.8	-	-	74.2	91	3.0	73.8	99	-	0.06			
3	6.5	4.7	0.0	0.90	0.08	46.5	30.6	3.8	1.2	82.1	-	-	74.6	90	3.2	82.1	110	-	0.09			

remarks (hor. 1 - 3): P-Olsen= 0

CLAY MINERALOGY (1 very weak, ..., 8 very strong) / EXTRACTABLE Fe Al Si Mn (by AMM. OXALATE(o), Na DITHIONITE(d) & PYROPHO(p))

Hor.

no. MI VE CH SM KA HA ML QU FE GI GO HE Fe(o) Al(o) Si(o) Fe(d) Al(d) Fe(p) Al(p) Pret pHNaF

1	-	-	-	8	-	4	-	-	-	-	0.99	0.23	0.20	-	-	-	-	-	-	-
2	-	-	-	8	-	4	-	-	-	-	0.81	0.21	0.21	-	-	-	-	-	-	-
3	-	-	-	8	-	4	-	-	-	-	0.79	0.20	0.18	-	-	-	-	-	-	-

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FAO/UNESCO (1988) (1974)	: Haplic Phaeozem, duripan phase
USDA/SCS SOIL TAXONOMY (1992)	: Entic Durustoll, fine silty, halloysitic, isohyperthermic
LOCAL CLASSIFICATION	: Series "Santo Domingo"
DIAGNOSTIC CRITERIA	FAO (1988) USDA/SCS (1992)
LOCATION	: Los Rizos, road El Crucero-Masachapa, Km 41; 50 m from electricity post
AUTHOR(S)	Latitude : 11°54' 0" N Longitude : 86°27' 0" W Vogel, Gutierrez
GENERAL LANDFORM	: piedmont
PHYSIOGRAPHIC UNIT	: Pacific Coastal Plain
SLOPE	Gradient : 4%
POSITION OF SITE	: middle slope
MICRO RELIEF	Kind : level
SURFACE CHAR.	Rock outcrop : little rocky Form : angular irregular Cracking : nil Salt : nil
SLOPE PROCESSES	Soil erosion : nil Slope stability : stable
PARENT MATERIAL	1 : volcanic ejecta Texture : loamy Weathering degree : partial or moderate Depth lithological boundary (cm): 115 Remarks :
EFFECTIVE SOIL DEPTH(cm)	: 23
WATER TABLE	Depth(cm) :
DRAINAGE	: moderately well to well
PERMEABILITY	: slow
FLOODING	Frequency : nil
MOISTURE CONDITIONS PROFILE	: 0 - 115 cm moist
LAND USE	: shrubland, grazed; no irrigation; Rotation : not relevant; Improvements : none
VEGETATION	Type : semi deciduous shrub Landuse/vegetation remarks : In past used for maize, beans, tomatoes
Additional REMARKS :	Shallow, (moderately) well drained, dark yellowish brown to (dark) brown silty clay loam to silt loam soil developed from volcanic ejecta, derived from unconsolidated pyroclastic materials. The soil contains fresh talpetate fragments, is weakly to moderately structured and moderately porous. The strongly cemented layers at 23 and 67 cm depth, called "talpetate" (Bm horizon) are in this part of Nicaragua probably of geogenetic and pedogenetic origin. The shallowness of the soil and the drought hazard due to the semi-dry climate determine the selected land use type. The profile forms part of a toposequence (El Crucero- Montelimar) of soils with "talpetate", studied by the Department of Soil Science of the Nicaraguan Agricultural University.
CLIMATE :	Köppen: Aw"
Station: MANAGUA	12 7 N/ 86 11 W
	40 m a.s.l
	41 km NE of site
	Relevance: moderate
No. years of record	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Annual
EP Penman mm	138 147 181 181 176 136 146 148 133 119 118 123 1746
precipitation mm	3 1 3 11 147 211 136 110 216 292 44 10 1184
tot.glob.rad. MJ/m ²	17.4 20.5 21.8 22.7 22.2 19.2 19.9 20.5 19.9 16.0 17.2 15.9 0.0
T mean °C	26.3 27.2 28.6 29.3 29.4 27.2 26.9 27.2 26.9 26.5 26.3 26.1 27.3
T max °C	31.6 33.0 34.6 35.2 34.7 31.4 31.1 31.7 31.5 30.9 31.2 31.5 32.4
T min °C	21.0 21.5 22.7 23.5 24.1 23.0 22.8 22.7 22.4 22.2 21.5 20.7 22.3
windspeed(at 2m) m/s	3.1 3.4 3.3 2.9 2.2 2.5 2.4 1.9 1.6 2.0 2.5 2.6 2.6
bright sunshine %	65 75 73 73 70 53 57 60 59 47 60 57 62

PROFILE DESCRIPTION :

- A 0 - 23 cm. dark yellowish brown (10YR 4.0/4.0, dry) silty clay loam; moderate medium subangular blocky to moderate medium angular blocky structure;, slightly hard; common fine continuous inped tubular pores and common very fine random continuous inped tubular pores; moderately porous; common very fine to coarse roots throughout; very few fine fresh "talpetate" fragments; abrupt smooth boundary to
- Bm 23 - 42 cm. strong brown (7.5YR 5.0/8.0, dry); strongly cemented broken platy duripan; abrupt smooth boundary to
- BC 42 - 67 cm. dark yellowish brown (10YR 3.0/6.0, dry) loam; weak to moderate fine to medium subangular blocky structure;, slightly hard; common very fine continuous inped tubular pores; moderately porous; few medium roots throughout and few coarse roots throughout; very frequent medium fresh "talpetate" fragments; clear broken boundary to
- C 67 - 88 cm. strong brown (7.5YR 4.0/6.0, dry) silt loam;; clear broken boundary to
- 2BW 88 - 115 cm. brown (7.5YR 4.0/4.0, dry) silty clay loam; moderate medium subangular blocky structure;, hard; common fine to coarse continuous inped tubular pores; moderately porous; few coarse roots between peds; very few very fine fresh pyroclastic fragments; clear wavy boundary to
- 2C 115 - cm. 5.0YR 4.0/4.0, dry silty clay loam; strong prismatic and strong medium angular blocky structure;, hard; few fine continuous inped tubular pores; slightly porous;; few small spherical manganiferous concretions; few fine weathered pyroclastic fragments;

ANALYTICAL DATA :

Hor. no.	Top - mm	Bot mm	>2	2000	1000	500	250	100	TOT	50	20	TOT	<2	DISP	BULK	pF-	---	---	---	---	---	
				1000	500	250	100	50	SAND	20	2	SILT	μm	DENS	0.0	1.0	1.5	2.0	2.3	2.7	3.4	4.2
1	0 - 23	-	1	1	2	7	4	14	9	44	53	33	11.0	0.94	63	61	55	47	45	40	33	25
2	23 - 42	-	19	15	9	11	3	57	11	24	35	8	4.0	-	-	-	-	-	-	-	-	-
3	42 - 67	-	1	3	7	12	8	30	14	36	50	20	10.0	0.81	66	64	56	49	47	43	38	32
4	67 - 88	-	1	2	5	11	6	24	15	38	54	22	10.0	-	-	-	-	-	-	-	-	-
5	88 - 115	-	0	0	1	4	5	10	13	41	54	36	15.0	1.07	57	56	50	45	44	41	34	32
6	115 - 115	-	0	0	1	4	4	9	16	47	63	28	13.0	-	-	-	-	-	-	-	-	-

Hor. no.	pH-	-- CaCO ₃	ORG-	MAT.	EXCH	CAT.	-----	-----	----- EXCH AC.	CEC	-----	-----	-----	BASE	AL	EC	2.5		
	H ₂ O	KCl	C	N	Ca	Mg	K	Na	sum	H+Al	Al	soil	clay	OrgC	ECEC	SAT	SAT	mS/cm	
1	6.4	5.0	0.0	4.41	0.42	25.5	5.2	1.7	0.1	32.5	-	-	46.6	140	15.4	32.5	70	-	0.06
2	6.4	5.3	-	0.30	-	13.2	4.3	1.1	0.3	18.9	-	-	30.3	-	-	62	-	0.06	
3	6.4	4.9	0.0	0.86	0.10	15.0	6.3	0.4	0.2	21.9	-	-	33.7	169	3.0	21.9	65	-	0.06
4	6.3	4.4	0.0	0.44	0.05	18.1	10.2	0.2	0.3	28.8	-	-	43.0	192	1.5	28.8	67	-	0.06
5	6.1	4.6	0.0	0.40	0.07	17.1	11.0	0.2	0.2	28.5	-	-	34.9	97	1.4	28.5	82	-	0.06
6	6.0	4.4	0.0	0.27	0.05	20.3	14.6	0.7	0.2	35.8	-	-	38.7	141	0.9	35.8	93	-	0.07

remarks (hor. 1) : P-Olsen= 1

remarks (hor. 3 - 6): P-Olsen= 0

CLAY MINERALOGY (1 very weak..., 8 very strong) / EXTRACTABLE Fe Al Si Mn (by AMM. OXALATE(o), Na DITHIONITE(d) & PYROPHO(p))

Hor.

no. MI VE CH SM KA HA ML QU FE GI GO HE Fe(o) Al(o) Si(o) Fe(d) Al(d) Fe(p) Al(p) Pret pHNaF

1	-	-	-	-	6	-	-	-	-	3.38	0.98	0.54	6.50	0.90	-	-	-	8.9
2	-	-	-	-	4	-	-	-	-	5.01	5.48	4.47	8.50	1.90	-	-	-	10.2
3	-	-	-	-	6	-	-	-	-	4.13	2.34	1.46	7.50	1.10	-	-	-	9.8
4	-	-	-	-	6	-	-	-	-	2.20	0.53	0.38	6.30	0.50	-	-	-	9.0
5	-	-	-	-	5	-	-	-	-	1.77	0.39	0.29	5.40	0.50	-	-	-	9.0
6	-	-	-	-	6	-	-	-	-	1.27	0.34	0.28	4.30	0.30	-	-	-	9.0

FAO/UNESCO (1988) (1974)	: Haplic Phaeozem, duripan phase													
USDA/SCS SOIL TAXONOMY (1992)	: Entic Durustoll, fine loamy, halloysitic, isohyperthermic (1975 : durustoll)													
DIAGNOSTIC CRITERIA	FAO (1988) USDA/SCS (1992)													
	: Diagnostic horizons : mollic A : Diagnostic properties : smearable consistency : Diagnostic horizons : mollic epipedon, duripan : Soil moisture regime : ustic													
LOCATION	: Montelimar, "Ingenio Julio Buitrago", 40 m west of offices sugar mill													
AUTHOR(S)	Latitude : 11°50' 0'' N Longitude : 86°31' 0'' W Altitude : 50 (m.a.s.l.) : Vogel, Gutierrez Date (mm.yy) : 11.92													
GENERAL LANDFORM	: plain													
PHYSIOGRAPHIC UNIT	: Pacific Coastal Plain													
SLOPE	Gradient : -%													
POSITION OF SITE	: flat													
MICRO RELIEF	Kind : ripples													
SURFACE CHAR.	Rock outcrop : fairly rocky Form : angular irregular Cracking : nil Salt : nil													
SLOPE PROCESSES	Soil erosion : nil Slope stability : stable													
PARENT MATERIAL	1 : unconsolidated Texture : mixed Weathering degree : partial or moderate Depth lithological boundary (cm) : 120 Remarks : Mix.alluvial,volcan.													
EFFECTIVE SOIL DEPTH(cm)	: 120													
WATER TABLE	Depth(cm) :													
DRAINAGE	: moderately well to well													
PERMEABILITY	: slow													
FLOODING	Frequency : nil													
MOISTURE CONDITIONS PROFILE	: 0 - 120 cm moist													
LAND USE	: medium level arable farming; Crops : sugar cane; seasonal irrigated; Rotation : monoculture; Improvements : none													
Landuse/vegetation remarks	: In the past used for fruit trees													
ADDITIONAL REMARKS :	Deep, (moderately) well drained, dark brown to dark reddish brown loam soil developed from unconsolidated materials, derived from igneous and sedimentary rocks as well as volcanic ejecta. The soil contains fresh talpetate fragments, is strongly to moderately structured, moderately permeable and highly porous. The strongly cemented layer at a depth of 42 cm called "talpetate" (Bm horizon) is in this part of Nicaragua probably of geogenetic and pedogenetic origin. The talpetate at shallow depth affects the rooting conditions, the nutrients and moisture availability and the potential for mechanization of the soil. The profile forms part of a toposequence (El Crucero- Montelimar) of soils with "talpetate", studied by the Department of Soil Science of the Nicaraguan Agricultural University.													
CLIMATE :	Köppen: Aw"													
Station: MANAGUA	12 7 N / 86 11 W													
	40 m a.s.l													
	60 km NE of site													
	Relevance: moderate													
	No. years of record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
EP Penman mm	138	147	181	181	176	136	146	148	133	119	118	123	1746	
precipitation mm	3	1	3	11	147	211	136	110	216	292	44	10	1184	
tot.glob.rad. MJ/m ²	17.4	20.5	21.8	22.7	22.2	19.2	19.9	20.5	19.9	16.0	17.2	15.9	0.0	
T mean °C	26.3	27.2	28.6	29.3	29.4	27.2	26.9	27.2	26.9	26.5	26.3	26.1	27.3	
T max °C	31.6	33.0	34.6	35.2	34.7	31.4	31.1	31.7	31.5	30.9	31.2	31.5	32.4	
T min °C	21.0	21.5	22.7	23.5	24.1	23.0	22.8	22.7	22.4	22.2	21.5	20.7	22.3	
windspeed(at 2m) m/s	3.1	3.4	3.3	2.9	2.2	2.5	2.4	1.9	1.6	2.0	2.5	2.6	2.6	
bright sunshine %	65	75	73	73	70	53	57	60	59	47	60	57	62	

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Country : NICARAGUA

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Print date (dd/mm/yy) : 04/06/94

PROFILE DESCRIPTION :

Ap	0 - 42 cm.	dark brown (7.5YR 3.0/2.0, moist) loam; strong medium granular structure;, firm; common fine continuous exped tubular pores and common very fine random continuous exped tubular pores; moderately porous; common fine roots throughout and common very fine roots throughout; frequent fine fresh "talpetate" fragments; frequent worm channels; abrupt smooth boundary to
Bm	42 - 51 cm.	strong brown (7.5YR 5.0/6.0, moist); strongly cemented discontinuous platy duripan; abrupt smooth boundary to
BC	51 - 92 cm.	5.0YR 3.0/4.0, moist loam; moderate medium subangular blocky structure;, very friable; many micro to very coarse continuous exped-inped tubular pores; highly porous; common fine roots throughout; very few medium fresh "talpetate" fragments; frequent worm channels; gradual smooth boundary to
C	92 - 120 cm.	5.0YR 3.0/4.0, moist clay loam; moderate medium to coarse subangular blocky to moderate medium to coarse prismatic structure;, very friable; many micro to very coarse continuous exped-inped tubular pores; highly porous;; dominant fine fresh "talpetate" fragments; frequent worm channels; clear smooth boundary to
2C	120 - cm.	strong brown (7.5YR 4.0/6.0, moist) loam; moderate medium to coarse subangular blocky structure;, friable; few very fine continuous inped tubular pores; slightly porous;;

ANALYTICAL DATA :

Hor. no.	Top - Bot mm	>2 1000	2000 500	1000 250	500 100	250 50	100 SAND	TOT 20	50 TOT	20 TOT	<2 2 SILT μm	DISP	BULK	pF- DENS	---							
															1.0	1.5	2.0	2.3	2.7	3.4	4.2	
1	0 - 42	-	1	3	6	13	8	31	11	32	43	27	-	1.02	61	60	55	48	46	41	33	25
2	42 - 51	-	14	17	10	9	6	56	12	24	36	8	5.0	-	-	-	-	-	-	-	-	-
3	51 - 92	-	1	2	4	14	7	28	12	36	48	24	-	0.85	63	60	53	45	44	39	31	24
4	92 - 120	-	0	1	2	10	9	21	15	36	51	28	-	1.06	58	56	50	45	45	42	39	34
5	120 - 150	-	2	4	6	12	5	29	14	35	48	23	-	1.17	55	54	52	49	49	47	44	38
Hor. no.	pH-H ₂ O	-- CaCO ₃	ORG-C	MAT-N	EXCH-Ca	CAT-Mg	----- EXCH-K	----- EXCH-Na	----- H+Al	AC-sum	CEC-Al	soil clay	EC	BASE-ECEC	Al-SAT	EC-SAT	2.5	mS/cm				
1	7.7	6.5	2.0	2.73	0.25	10.8	2.1	9.6	0.1	22.6	-	-	15.2	57	9.6	22.6	149	-	0.13			
2	7.1	6.2	2.1	0.30	-	30.9	5.1	1.5	0.6	38.1	-	-	37.5	-	-	-	100	-	0.16			
3	7.6	6.3	2.1	0.02	0.13	8.8	1.7	0.9	0.2	11.6	-	-	11.8	50	0.1	11.6	98	-	0.11			
4	7.6	5.9	1.9	0.33	0.06	12.1	3.8	1.2	0.2	17.3	-	-	18.4	65	1.2	17.3	94	-	0.12			
5	7.5	5.8	1.8	0.41	0.06	8.9	2.9	0.6	0.1	12.5	-	-	13.4	58	1.4	12.5	93	-	0.11			

remarks (hor. 1) : P-Olsen= 31

remarks (hor. 3) : P-Olsen= 4

remarks (hor. 4) : P-Olsen= 1

remarks (hor. 5) : P-Olsen= 3

CLAY MINERALOGY (1 very weak..., 8 very strong) / EXTRACTABLE Fe Al Si Mn (by AMM. OXALATE(o), Na DITHIONITE(d) & PYROPHO(p))

Hor.

no. MI VE CH SM KA HA ML QU FE GI GO HE Fe(o) Al(o) Si(o) Fe(d) Al(d) Fe(p) Al(p) Pret pHNaF

1	-	-	-	-	-	4	-	-	-	-	1.56	0.70	0.46	5.20	0.60	-	-	-	9.3
2	-	-	-	-	-	4	-	-	-	-	4.02	3.83	2.96	6.30	1.40	-	-	-	10.1
3	-	-	-	-	-	5	-	-	-	-	2.21	0.84	0.64	6.30	0.80	-	-	-	9.6
4	-	-	-	-	-	6	-	-	-	-	1.24	0.36	0.31	4.20	0.30	-	-	-	9.5
5	-	-	-	-	-	6	-	-	-	-	1.27	0.49	0.40	4.20	0.40	-	-	-	9.6

APPENDIX 1 REFERENCES AND LITERATURE

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APPENDIX 2 FIELD METHODS

The soils are described in the field according to ISRIC's Guidelines for the description and coding of soil data (van Waveren & Bos, 1988; 1994). These guidelines follow closely those for soil description given by FAO (1977) and FAO-ISRIC (1990). Soil colours are determined using either the Munsell Soil Color Charts or the Revised Standard Soil Color Charts (Oyama & Takehara, 1967).

Soil columns are taken for monolith preparation using the methods described by van Baren & Bomer (1979). In addition, disturbed and undisturbed samples are collected for physical, chemical and mineralogical analyses and for thin section preparation, where possible using the guidelines for the sampling of soil horizons for a soil reference collection (NASREC Newsletter no. 1 (March, 1991). Of all sites slides and photographs are taken showing the landscape, vegetation, land use, soil profile and important profile details. Furthermore, data are collected with each pedon on climate, land use history, crops and crop yields, soil management practices, etc.

Soils are classified according to the FAO-Unesco Legend of the Soil Map of the World (1974) and its Revised Legend (FAO, 1988). Soil subunit modifiers ("third level") were added using the proposals given by Nachtergaele et al. (1994). In addition soil were given their classification according to Soil Taxonomy (Soil Survey Staff, 1975; 1992), and, if available, the local classification.

All data are stored in ISIS version 4.0 (ISRIC, 1994), ISRIC's soil pedon data management system for micro computers. The information given on the soil data sheets in this publication have been generated from the ISIS files.

APPENDIX 3 ANALYTICAL METHODS

Preparation

Each sample is air-dried, cleaned, crushed (not ground), passed through 2 mm sieve, homogenized. Moisture content is determined at 105° C.

pH H₂O

(1:2.5): 20 g of soil is shaken with 50 ml of deionised water for 2 hours, electrode in upper part of suspension.

pH-KCl

Likewise but shaken with 1M KCl.

EC

(1:2.5): Conductivity of pH-H₂O suspension.

Particle-size distribution

Soil is treated with 15% hydrogen peroxide overnight in the cold, then on waterbath at about 80°C. Then boiled on hot plate for 1 hour. Washings until dispersion. Dispersing agent is added (20 ml solution of 4% Na-hexametaphosphate and 1% soda) and suspension shaken overnight. Suspension sieved through 50 µm sieve. Sand fraction remaining on sieve dried and weighed. Clay and silt determined by pipetting from sedimentation cylinder.

Water-dispersable clay

Pipetting after shaking 20 g of soil overnight (16 hours) with deionized water.

Specific surface area

Saturation with ethylene glycol monoethyl ether (EGME), excess removal by vacuum suction. Mass of retained monomolecular layer of EGME is measure for surface area.

Exchangeable bases and CEC

Percolation with 1M ammonium acetate pH7 using automatic extractor.

(If EC>0.5mS pre-leaching with ethanol 80%). Cations are determined in the leachate by AAS.

CEC: saturation with sodium acetate 1M pH7; washed with ethanol 80% and then leached with ammonium acetate 1M pH7. Na determined by FES.

Exchangeable acidity and aluminium

The sample is extracted with 1M KCl solution and the exchange acidity (H+Al) titrated with NaOH. Al is measured by AAS.

Carbonate

Piper's procedure. Sample is treated with dilute acid and the residual acid is titrated.

Organic carbon

Walkley-Black procedure. The sample is treated with a mixture of potassium dichromate and sulphuric acid at about 125°C. The residual dichromate is titrated with ferrous sulphate. The result expressed in % carbon (because of incomplete oxidation a correction factor of 1.3 is applied).

Total nitrogen

Micro-Kjeldahl. Digested in H₂SO₄ with Se as catalyst. Then ammonia is distilled, trapped in boric acid and titrated with standard acid.

P-Bray 1

Phosphate is extracted with a mixture of 0.025M HCl + 0.03M NH₄F and determined colorimetrically.

P-Olsen

Phosphate is extracted with 0.5M NaHCO₃ solution pH 8.5 and determined colorimetrically.

P-retention

Blakemore et al. Shaken with (KH₂PO₄ + NaAc) solution, 1000 mg/L P pH 4.6 for 16 hours.

Determination of residual P colorimetrically after centrifuging.

pH-NaF

To 1g of soil 50 ml of NaF 1M is added and stirred for 1 minute.

Reading pH by continuous stirring exactly 2 minutes after adding NaF solution.

Extractable iron, aluminium, manganese and silicon

All determinations by AAS.

1. "Free" (Fe, Al, Mn): Holmgren Shaken with sodium citrate (17%) + sodium dithionite (1.7%) solution for 16 hours.
2. "Active" (Fe, Al, Si): Shaken with acid ammonium acetate 0.2M pH 3 for 4 hours in the dark.
3. "Organically bound" (Fe, Al): Shaken with sodium pyrophosphate 0.1M for 16 hours.

Clay mineralogy

Clay is separated as indicated for particle-size analysis.

about 10-20 mg of clay is brought on porous ceramic tile by suction and analyzed using a Philips diffractometer.

Soluble salts

Measuring pH, EC, cations and anions in water extracts.

1. 1:5 extract. Shaking 30 g of fine earth + 150 ml of water for 2 hours.
2. saturation extract. Adding to 200-1000 g fine earth just enough water to saturate the sample. Standing overnight.

After filtration Ca, Mg, Na, K are measured by AAS. Cl with the Chlorocounter and SO₄ turbidimetrically.

Gypsum

To 10 g of fine earth 100 ml of water is added, shaken overnight and centrifuged.

Precipitation by adding acetone. Precipitate redissolved in water and determination of Ca by AAS.

Elemental composition

The fine earth is dried, ignited and fused with lithium tetraborate.

The formed bead is analyzed by X-ray fluorescence spectroscopy.

Moisture retention

Moisture determinations on undisturbed core samples in silt box (pF1.0; 1.5; 2.0) and kaolinite box (pF2.3; 2.7) respectively and on disturbed samples in high pressure pan (pF3.4; 4.2).

Bulk density obtained from dry weight of core sample.

APPENDIX 4 SLIDE LIST OF THE REFERENCE PROFILES

Monolith	Slide nr.	Subject	Remarks
NI005	13656	other	Crater of Masaya Volcano, source of parent material monolith NI005
NI005	13657	other	Close-up crater of Masaya Volcano, source of parent material monolith NI005
NI005	13658	other	Close-up crater of Masaya Volcano, source of parent material monolith NI005
NI005	13659	vegetation	Vegetation on recent pyroclasts; background volcano Masaya
NI005	13660	vegetation	Vegetation next to road to Lagoon
NI005	13661	other	Profile pit with surrounding vegetation
NI005	13662	profile	
NI005	13663	profile	
NI005	13664	profile	Close up profile
NI005	13665	profile details	Fresh lava as part of C-horizon
NI005	13666	landscape	Landscape in direction of monoliths NI006 and NI007
NI006	13667	landscape	At the background Masaya Volcano, source of parent material
NI006	13668	crops	Immediate surroundings profile pit with Masaya Volcano at background
NI006	13669	crops	Profile pit, 10m from tree
NI006	13670	crops	Close up 13669
NI006	13671	other	Monolith preparation
NI006	13672	profile	
NI006	13673	profile details	Recent soil profile, separated by ash layer (55-70cm) from buried profile(13674)
NI006	13674	profile details	Buried profile in subsoil
NI006	13675	profile details	Subsoil with parent material buried soil profile (13674)
NI006	13676	biological activity	Termite activity at 50 cm depth.
NI006	13677	biological activity	Close up termite activity (13676)
NI007	13678	landscape	At the background Volcano Masaya
NI007	13679	crops	At the background soil profile pit; sorghum as crop
NI007	13680	crops	With profile pit
NI007	13681	crops	As 13680, but taken in other direction
NI007	13682	other	Activities related to the taking of the soil monolith
NI007	13683	other	Agro-forestry experiment with maize and leucaena, 100m from profile pit
NI007	13684	other	as 13683
NI007	13685	profile	
NI007	13686	profile	
NI007	13687	other	Monolith preparation
NI007	13688	profile details	Duripan features, at 43 and 57 cm depth, locally called talpetate
NI007	13689	profile details	Duripan (see 13688) with parent material = tuff
NI007	13690	other	Parent material at greater depth

NI008	13691	landscape	
NI008	13692	landscape	At the background
NI008	13693	crops	Irrigated sugar-cane
NI008	13694	other	Profile location
NI008	13695	other	Profile location
NI008	13696	other	Close up 13695
NI008	13697	profile	
NI008	13698	profile	
NI008	13699	profile details	Upper profile
NI008	13700	profile details	Lower part profile with parent material = tuff
NI008	13701	biological activity	
NI008	13702	biological activity	Close up 13701
NI008	13703	other	Parent material = tuff
NI008	13704	other	Parent material = tuff
NI008	13705	other	Piece of parent material = tuff
NI008	13739	other	Monolith preparation NI008 - first slide of series of 7
NI008	13740	other	Serie on monolith preparation (no. 2) - micromorphological sampling
NI008	13741	other	Serie on monolith preparation (no. 3)
NI008	13742	other	Serie on monolith preparation (no. 4)
NI008	13743	other	Serie on monolith preparation (no. 5)
NI008	13744	other	Serie on monolith preparation (no. 6)
NI008	13745	other	Serie on monolith preparation (no. 7)
NI009	13706	landscape	
NI009	13707	land use	Profile location
NI009	13708	surface characteristic	Cracks at the surface = 30 cm deep
NI009	13709	surface characteristic	See 13709
NI009	13710	profile	
NI009	13711	profile	Profile with cracks
NI009	13712	profile details	Topsoil with cracks
NI009	13713	profile details	See 13712
NI009	13714	profile details	Slickensides
NI010	13715	landscape	View towards Pacific coast
NI010	13716	landscape	View towards Pacific Volcanic Cordillera (El Cruero - see slide 13715)
NI010	13717	vegetation	
NI010	13718	other	Profile pit with surrounding natural vegetation
NI010	13719	profile	
NI010	13720	profile	
NI010	13721	profile details	Upper part profile
NI010	13722	profile details	Duripan (23 - 43cm)

NI010	13723	profile details	Duripan (23 - 42cm)
NI010	13724	profile details	Duripan detail
NI010	13725	profile details	Rooting through duripan
NI010	13726	profile details	Upper view of duripan
NI010	13727	profile details	Side view of duripan
NI010	13728	profile details	Upper view of duripan
NI011	13729	landscape	
NI011	13730	landscape	
NI011	13731	crops	Irrigated sugarcane
NI011	13732	crops	Irrigated sugarcane
NI011	13733	crops	Sugarcane factory
NI011	13734	other	Profile location, border sugar cane field
NI011	13735	profile	Upper view profile pit
NI011	13736	profile	
NI011	13737	profile	Upper part profile with duripan (42 - 51cm)
NI011	13738	profile details	Duripan

Country Reports¹
(ISSN: 1381-5571)

No.	Country	No. of soils	No.	Country	No. of soils
1	Cuba	22	15	Gabon	6
2	P.R. of China	51	16	Ghana	in prep.
3	Turkey	15	17	Philippines	6
4	Côte d'Ivoire	7	18	Zimbabwe	13
5	Thailand	13	19	Spain	20
6	Colombia	18	20	Italy	17
7	Indonesia	48	21	Greece	in prep.
8	Ecuador	in prep.	22	India	in prep.
9	Brazil	28	23	Kenya	in prep.
10	Peru	21	24	Mali	in prep.
11	Nicaragua	11	25	Nigeria	in prep.
12	Costa Rica	12	26	Mozambique	in prep.
13	Zambia	11	27	Botswana	in prep.
14	Uruguay	10	28	Malaysia	18

¹ as of June 1995