
Report No. 412 (ICAR)

April 1978

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Report on
Soil Survey of National Goat Research Centre I.V.R.I.
at Farah, District Mathura (U. P.)

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REPORT ON SOIL SURVEY
of
NATIONAL GOAT RESEARCH CENTRE, I.V.R.I.
AT FARHĀ, DISTRICT MATHURA (U.P.)

1. INTRODUCTION :

1.1 Detailed Soil Survey of the National Goat Research Centre, Makhdoom Farm at Farhā, District Mathura, Uttar Pradesh, under the Indian Veterinary Research Institute of the Indian Council of Agricultural Research was carried out at the request of the Director I.V.R.I. in pursuance of the policy of the I.C.A.R. to carry out Soil Survey of all Research Farms.

1.2 The objectives of survey were to prepare a Detailed Soil Map of the Farm by delineating types and phases of soil series, identify problems and suggest the best use and management of the soils.

1.3 The survey was carried out during the period 18th January to 11th February, 1977

2. GENERAL ^{description} DISTRIBUTION OF THE AREA :

2.1 Location and Extent -

The Makhdoom Farm is situated about 22 Km away from Mathura on Mathura-Agra road. The area is along the river Yamuna which flows from north to south. Village Farhā is towards south-west of the area and is on the Delhi-Agra National High Way. The total mapped area of the Farm is about 300 ha. (~~780~~-Ac).

2.2 Climate -

3 The present climate is semi-arid to sub-humid. May and June are generally the hottest months and December and January the coldest. The mean maximum temperature during summer months (April, May, June) is 39.6°C and varies from 37.7°C to 41.8°C. From August onwards it shows a decreasing trend and drops to a minimum of 2.7°C in the month of January. The climatic data is presented in the following table. (contd...2/..)

CLIMATOLOGICAL TABLE

Station Agre : Lat. 27°10' N, Long. 78°02' E, Height
above M.S.L. 169 Metres

(Based on observations from 1939 to 1960)

Month	Mean Temp. in °C		High	Low	Humidity %	Rainfall in mm. (Average)
	Daily Max.	Daily Min.				
January	22.2	7.4	27.2	2.7	73 45	16.2
February	25.7	10.3	31.5	5.0	64 32	8.8
March	31.9	15.7	37.8	9.2	47 24	10.9
April	37.7	21.6	42.5	15.5	32 18	5.3
May	41.8	27.2	45.4	21.4	30 21	10.0
June	40.5	29.5	45.0	24.0	48 34	60.0
July	34.8	27.0	40.7	28 -	218x2 75 66	210.2
August	32.8	25.8	35.9	-	81 75	263.2
September	33.2	24.6	36.5	-	77 62	151.5
October	33.3	19.1	36.5	-	59 40	23.5
November	29.2	12.0	33.0	7.1	61 33	2.1
December	24.1	8.2	28.1	3.8	68 40	3.7
Average	32.3	19.0			60 41	765.4

The monsoon showers begin in July and extend upto September. The average annual rainfall is 765.4 mm. out of which about 85% is received during three months, July to September.

Rainfall and temperature conditions are favourable to grow all climatically adapted forage and agricultural maximum crops that mature in 90-120 days duration in the normal years of rainfall during Kharif season.

2.3 Physiography, Relief and Drainage -

The farm area is a part of the flood plain of river Yamuna. The general topography of the area is mostly undulating with relief difference of upto 5 to 6 meters between low level lands and the top of the levees. The farm area is characterized by numerous chan is due to dissection. The land is gently sloping to sloping. A small area of the farm is level to nearly level.

The area drains into Yamuna river. The surface drainage is good.

2.4 Geology -

Geologically the area comes under Yamuna alluvium.

2.5 Vegetation -

The main natural vegetation on the farm and surrounding area is Sheesham (*Dalbergia sisoo*), Babool (*Prosopis juliflora*), Chonkur (*Prosopis spicigera*), Kharjal (*Salvadora persica*) Peeleo (*Salvadora elcoides*) Bery (*Cassia tomentosa*), Hinsa (*Mimosa himalayana*) Arni (*Melastoma rhamnoides*), Neem (*Azadirachta indica*), Peepal (*Ficus religiosa*) Khajoor (*Phoenix sylvestris*) and Banian (*Ficus bengalensis*).

Deh (*Cynodon dactylon*), Ajan (*Aclanthus excelsa*), Kank (*Saccharum spontaneum*), Lampa (*Heteropogon contortus*) and Kunj (*Eriochloa juncea*) are the important grass species encountered in the area.

2.6 Present Land Use -

6
Total area of the Farm is 300 ha (750 acres) out of which only a part of the area is under cultivation at present. Most of the area is under forest and grasses. The proposed land use pattern by the Institute is as follows:-

100 ha for Agriculture use,
100 ha for Pasture and
100 ha for Forest.

General cropping followed by the farmers
around the area.

Most of the area is under rainfed farming.

<u>Crop</u>	<u>Seed/ha</u>	<u>Yield/ha</u>
Wheat	1.5 to 2 Qtl.	15 to 20 Qtl.
Early	1.25 to 1.5 Qtl.	35 to 40 Qtl.
Gram	90 Kg to 1 Qtl.	25 to 35 Qtl.
Laha	3.5 Kg to 4.5 Kg	20 to 22 Qtl.
Mustard	4.5 to 5 Kg	17 to 22 Qtl.
Masoor	4.5 to 5 Kg	8 to 10 Qtl.
Bajra	4.5 to 5 Kg	8 to 10 Qtl.
Gwar	17 to 22 Kg	17 to 22 Qtl.
Mung (mix)	1 to 1.5 Kg	2 to 2.5 Qtl.
Urd (mix)	1 to 1.5 Kg	2 to 2.5 Qtl.
Moth (mix)	1 to 1.5 Kg	2 to 2.5 Qtl.
Arhar (mix)	4.5 to 5 Kg	17 to 22 Qtl.
Jwar	9 to 12 Kg	17 to 20 Qtl.
Til (mix)	1 to 1.5 Kg	90 to 110 Kg
Ramans (mix)	1 Kg	1 to 1.5 Qtl.

Cow-dung manure from 40 to 50 carts load/ha,
Diammonium phosphate and Urea are used in the wheat
and six Early crops under 6 to 7 irrigations for
wheat and 3 for Early. Rest of the crops are rainfed.

3. SOILS :

3.1 Soil Survey Technique -

Detailed Soil Survey of the farm was carried
out on 1:62,500 scale map provided by the
National Sheep and Goat Research Institute, I.V.R.I. -
Makhdoom Farm, Mathura. The map supplied was not showing
the natural features like, sales, roads and important
drains. As such it was difficult to locate ground
control points. About one week was spent in surveying
the important features which were shown on the provided

map. All the major drainage channels, roads and naals were located.

The procedure followed involved field study of soil ~~as~~ by posthole auger ~~hole~~ observations upto 125 cm depth during field traverse and morphological studies of the soil profiles. Two hundred and three auger holes were studied at regular intervals for colour, texture, mottles and calcium carbonate. Surface features like slope, erosion, field conditions ^{etc} were recorded during the traverse. Similar soils based on the above observation were grouped and soil boundaries were marked on the map.

Representative soils were further studied upto 1.5 metre in open dug pits. Morphological features like soil colour, texture, structure formation of horizon and their thickness, movement of clay, biological activity, presence or absence of concretions and mottles etc. were noted. Eight soil profiles were studied and soil samples were collected for laboratory investigations. The mapping units shown on the soil map are soil phases ^{etc}, surface soil texture, and slope ^{etc} erosion.

3.2 Mapping Unit Description -

Soil map shows mapping unit as phases of soil series boundaries and interpreted land capability units. Following is the description of mapping units observed in the area.

3.3 Description of Soils -

Seven different soil series named tentatively as A, A₁, B, B₁, C, D and E were identified during the survey. The brief general characteristics of these soils mapped in the farm are given below followed later by detailed soil series descriptions.

3.3.1 Soil Series A (62.12 Ha) -

Comprises very deep, some what excessively drained, loamy sand to sand on gently sloping land with sandy loam to loamy sand surface texture.

Mapping Units : A₂A, A₂B-C, AbB-C and AbBD.

3.3.2 Soil Series A₁ (61.94 ha) -

Comprises very deep, somewhat excess ly drained, highly calcareous, loamy sand to sandy on level, to nearly level and gently sloping land with sandy loam to loamy sand surface texture.

Mapping Units : A₁a B-C, A₁b B-C, A₂BD & AbBD.

3.3.3 Soil Series B (57.54 ha) -

Comprises very deep, well drained, generally sandy loam soils with loamy sand to sandy loam surface texture on gently sloping land.

Mapping Units : BbB-C and BbBD.

3.3.4 Soil Series B₁ (11.44 ha) -

Comprises very deep, well drained, highly calcareous, generally sandy loam soils with sandy loam soils with sandy loam to loamy sand surface texture, on gently sloping land.

Mapping Units : B₁bB-C.

3.3.5 Soil Series C (60.34 ha) -

Comprises very deep, somewhat excessively drained, sandy loam over sandy soils with loamy sand to sandy loam surface texture, on gently sloping lands.

Mapping Units : CbB-C.

3.3.6 Soil Series D (21.02 ha) -

Comprises moderately well drained to well drained very deep, highly calcareous, clay loam soils on nearly level to gently sloping lands with sandy loam to loam surface texture.

Mapping Units : DcB, DdB-C.

3.3.7 Soil Series E (4.60 ha) -

Comprises very deep, moderately drained, calcareous, highly stratified layers of silt loam to sand texture, on level to nearly level lands, with sandy loam to silt loam surface texture.

Mapping Units : Eca.

DETAILED DESCRIPTION OF SOIL SERIES :

'SERIES A'

Comprises very deep, somewhat excessively drained, pale brown to brownish yellow soil of loamy sand to sand (with loamy sand to sandy loam surface), occurring on gently sloping lands.

Classification : Member of non-acid, mixed, hyperthermic family of Typic Ustipsamments.

Typifying Pedon : Very deep loamy sand, (under levelling.)

Description of a typical soil profile (No. 1 indicated on the map) examined in south east of the farm is given below : -

Horizon	Depth (cm)	Description
Ap	0-20	Yellowish brown (10YR 5/6 moist) loamy sand; weak, medium, subangular blocky; slightly hard; friable; non-sticky and non-plastic; plentiful thick and thin roots; clear and smooth boundary.

(contd...8/..)

C ₁₁	20-54	Yellowish brown (10YR 5/5, moist) sand; single grain, loose; non-sticky and non-plastic; common thick and thin roots; gradual and smooth boundary.
C ₁₂	54-110	Yellowish brown (10YR 5/5, moist) loamy sand; weak, medium, subangular blocky; friable; non-sticky and non-plastic; few fine roots; clear and smooth boundary.
C ₁₃	110-157	Light yellowish brown (10YR 6/4, moist) sand; single grain; loose; non-sticky and non-plastic.

PARTICLE SIZE DISTRIBUTION

Horizon	Depth (cm)	Coarse sand%	Fine sand%	Coarse silt%	Fine silt%	Total silt	Clay %
Ap	0-20	7.19	72.61	7.63	7.22	14.85	6.57
C ₁₁	20-54	-	-	-	-	-	-
C ₁₂	54-110	13.29	65.44	6.84	6.50	13.34	7.25
C ₁₃	110-157	22.32	67.35	4.30	3.25	7.55	4.75

PHYSICO-CHEMICAL PROPERTIES

Depth (cm)	pH (1:2.5)	E.C. 1:2 mho/cm.	CaCO ₃ %	O.C. %	W.H.C. %	CEC m.eq/100 g. soil	Exchangeable cations M.eq/100 g.			
							Ca	Mg	Na	K
0-20	7.8	0.2	nil	0.19	29.90	6.34	3.00	1.50	1.48	0.19
20-54	7.8	< 0.2	*	0.07	29.00	6.53	2.25	1.75	1.30	0.75
110	8.0	< 0.2	*	0.07	30.00	6.62	3.75	2.25	0.26	0.06
110-157	8.2	< 0.2	*	0.15	28.54	4.53	3.00	1.00	0.28	0.06

Range in Characteristics -

The colour of the surface soil ranges from pale brown to yellowish brown and texture varies from loamy sand to sandy loam, sub-soil colour ranges from yellowish brown to light yellowish brown and texture is generally loamy sand.

(contd.....9/....)

Drainage and permeability -

Some what excessively drained with rapid permeability.

'SERIES A₁'

Comprises very deep, somewhat excessively drained highly calcareous, pale brown to brownish yellow soils of loamy sand to sand (with loamy sand to sandy loam, surface) occurring on gently sloping land.

Classification : Member of non-acid, calcareous, mixed hyperthermic family of Typic Ustipsamments.

Typifying Pedon : Very deep, loamy sand, vergin land under forest.

Description of a typical soil profile (No.2 indicated on the map) examined south west of the farm is given below : -

<u>Horizon</u>	<u>Depth</u> (cm)	<u>Description</u>
Ap	0-30	Pale brown (10YR 6/3, Dry), light yellowish brown to brownish yellow (10YR 6/5, moist); loamy sand; weak, medium, subangular blocky, soft, friable, non-sticky and non-plastic; plentiful thin roots; violent effervescence with dilute HCl; clear and smooth boundary.
C ₁₁	30-65	Pale brown (10YR 6/3, Dry), yellowish brown (10YR 5/5, moist); loamy sand; weak, medium, subangular blocky; friable, non-sticky and non-plastic; many thin and fine roots; violent effervescence with dilute HCl; 7 to 10% lime nodules of 3 to 5 cm; irregular in shape, clear and smooth boundary.
F ₂	65-110	Light brownish yellow (10YR 6/2, Dry), pale brown (10YR 6/3, moist) loamy sand; <i>single</i> xxxxxx grain; loose, non-sticky and non-plastic; single strong effervescence with dilute HCl; many thin and fine roots.

(contd....10/.....)

PARTICLE SIZE DISTRIBUTION

Horizon	Depth (cm)	Coarse sand%	Fine sand%	Coarse silt%	Fine silt%	Total silt	Clay %
	0-30	9.92	72.95	3.79	7.10	10.89	6.40
C ₁₁	30-65	5.60	70.52	12.00	5.85	17.85	6.03
C ₁₂	65-110	3.65	80.37	8.32	3.47	11.79	6.98

PHYSICO-CHEMICAL PROPERTIES

Depth (cm)	pH (1:2.5)	E.C. 1:2	CaCO ₃ %	O.C. %	WHC %	M.E. %	CEC M.eq/100 soil	Exchangeable Cations M.eq/100 g.			
								Ca	Mg	Na	K
0-30	8.75	< 0.2	9.60	0.12	25.15	5.22	4.90	3.50	0.75	0.50	0.11
30-65	8.92	< 0.2	4.40	0.09	28.54	3.90	3.54	2.75	0.25	0.35	0.08
65-110	9.00	< 0.2	3.30	0.16	29.34	3.65	3.26	2.65	0.20	0.33	0.08

Range in Characteristics -

The colour of the surface soil ranges from pale brown to yellowish brownish brown and texture varies from loamy sand to sandy loam. Sub-soil colour ranges from pale brown to light brownish yellow and texture is generally loamy sand over sand.

Drainage and Permeability -

Somewhat excessively drained with rapid permeability.

'SERLEX B'

Comprises very deep, well drained, strong brown to yellowish brown, sandy loam soils with sandy loam to loamy sand surface textures. These occur on gently sloping lands.

Classification : Member of coarse loamy, non-acid, mixed, hyperthermic family of Typic Ustertent.

Typifying Pedon : Very deep sandy loam, vergin land.

Description of a typical soil profile (No.3 indicated on map) examined south west of the farm is given below : -

(contd...11/....)

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<u>Horizon</u>	<u>Depth</u> (cm)	<u>Description</u>
Ap	0-11	Brownish yellow (10 6/6, Dry), yellowish brown (10YR 5/6, moist); sandy loam; weak, medium, angular blocky; slightly hard, friable; non-sticky and non-plastic; plentiful thick and thin roots; clear and smooth boundary.
C ₁₁	11-25	Strong brown (7.5YR 5/6, moist) sandy loam; weak, medium, angular blocky; slightly hard; friable; slightly sticky and non-plastic; many thick and thin roots; clear and smooth boundary.
C ₁₂	25-102	Strong brown (7.5YR 5/6, moist); sandy loam; weak, medium, angular blocky, slightly hard; friable; slightly sticky and non-plastic; few thick and many fine roots; clear and smooth boundary.
C ₁₃	102-150	Yellowish brown (10YR 5/6, moist) sandy loam; weak, medium, subangular blocky, friable; non-sticky and non-plastic; few fine and thin roots.

PARTICLE SIZE DISTRIBUTION

<u>Horizon</u>	<u>Depth</u> (cm)	<u>Coarse sand%</u>	<u>Fine sand%</u>	<u>Coarse silt%</u>	<u>Fine silt%</u>	<u>Total silt</u>	<u>Clay %</u>
Ap	0-11	7.42	65.80	8.61	6.30	14.91	9.52
C ₁₁	11-25	0.90	52.35	25.00	8.92	33.92	12.25
C ₁₂	25-102	1.23	56.36	18.00	10.23	28.23	13.80
C ₁₃	102-150	2.30	63.56	18.65	9.33	27.98	6.67

(contd.....12/.....)

PHYSICO-CHEMICAL PROPERTIES

Depth cm	pH/ (1:2.5)	E.C. 1:2	CaCO ₃ %	O.C. %	WHC %	M.E. %	CEC M.eq/ g. soil	Exchangeable Cations M.Eq/100 g.			
								Ca	Mg	Na	K
0-11	7.4	< 0.2	-	0.22	25.75	4.33	7.07	3.75	2.75	-	-
11-25	7.5	< 0.2	-	0.15	27.08	6.68	7.79	3.75	3.50	-	-
25-102	7.65	< 0.2	-	0.13	26.55	6.95	9.79	5.50	2.50	-	-
102-150	8.1	< 0.2	-	22.55 0.12	27.35	6.20	6.53	4.25	1.75	-	-

Range in Characteristics -

The colour of the surface soil ranges from brownish yellow to yellowish brown and texture varies from loamy sand to sandy loam. Sub-soil colour ranges from yellowish brown to strong brown and texture is generally sandy loam.

Drainage and Permeability -

Well drained to somewhat excessively drained with rapid permeability.

'SERIES B₁'

Comprises very deep, well drained, calcareous, light yellowish brown to yellowish brown, sandy loam soils (with sandy loam to loamy sand surface texture) occurring on gently sloping lands. Extent of CaCO₃ from 5% to 50% by volume is seen in most of the cases, the content increasing in the depth.

Classification : Member of coarse loamy, non-acid, mixed, hyperthermic family of Fluventic Ustochrepts.

Typifying Pedon : Very deep, sandy loam, under forest.

Description of a typical soil profile (No. 4 indicated on map) examined in south east of the farm is given below.

(contd....13/...)

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<u>Horizon</u>	<u>Depth (cm)</u>	<u>Description</u>
Ap	0-6	Light yellowish brown (10YR 6/4, dry) yellowish brown (10YR 5/6, moist) sandy loam; weak, medium, subangular blocky; slightly hard; friable; non- sticky and non-plastic; clear and smooth boundary.
B ₁₂	6-26 <i>concretion</i>	Brownish yellow (10YR 6/5 dry) yellowish brown (10YR 5/6, moist) loamy sand; weak, medium, subangular blocky; friable; non-sticky and non-plastic; slight effervescence with dilute HCl; few lime concretions; plentiful thick & thin roots; clear and smooth boundary.
IC ₁₁	26-40	Yellowish brown (10YR 5/6, moist) sandy loam; weak, medium subangular blocky; friable; non-sticky and non- plastic; strong effervescence with dilute HCl; few lime concretions of 0.5 to 1 cm; few thick and abundant; thin roots; clear and smooth boundary.
IC ₁₂	40-69	Yellowish brown (10YR 5/6, moist) sandy loam; weak, medium, subangular blocky; structure, friable, non-sticky and non-plastic; violent effervescence with dilute HCl; lime concretions upto 5% by volume; clear and smooth boundary.
IC ₁₃	69-99	Yellowish brown (10YR 5/6, moist); loam; weak, medium, subangular blocky; friable; non-sticky and non-plastic; violent effervescence with dilute HCl; lime concretions upto 25% by volume; clear and smooth boundary.
IC ₂	99-120	Yellowish brown brown (10YR 5/6; moist); silt loam; weak, medium, subangular blocky; friable; non-sticky and non- plastic; violent effervescence with dilute HCl; lime concretions upto 50% by volume of 5 to 8.0 cm size; clear and smooth boundary.
IC ₃	120-139	Yellowish brown (10YR 5/6, moist); loam; weak, medium, sub-angular blocky; structure; friable; slightly sticky and non-plastic; violent effervescence with dilute HCl; lime concretions upto 13% by volume of 1.00-7.0 cm size; clear and smooth boundary.

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IVC₃ 139-165 Yellowish brown (10YR 5/ moist); sandy loam; weak, medium, subangular blocky; stiffable; slightly sticky and non-plastic; violent effervescence with dilute HCl; lime nodules upto 10% by volume of 2.0 to 8.0 cm sizes

PARTICLE SIZE DISTRIBUTION

Horizon	Depth (cm)	Coarse sand%	Fine sand%	Coarse silt%	Fine silt%	Total silt	Clay %
Ap	0-6	4.23	69.01	11.36	3.47	14.83	7.50
B ₁₂	6-26	7.72	63.31	12.30	6.00	18.30	9.00
IIC ₁₁	26-40	3.20	55.25	18.85	14.00	32.85	11.00
IIC ₁₂	40-69	2.84	52.78	20.20	13.50	33.70	10.25
IIC ₁₃	69-99	5.37	44.71	29.77	10.75	40.52	10.00
IIC ₂	99-120	2.47	32.49	30.17	30.00	60.17	6.00
<u>IVC₃</u>	120-139	1.86	48.02	33.19	8.25	41.44	8.75
<u>IVC₃</u>	139-165	1.82	60.11	25.82	8.25	34.07	6.75

Physico-Chemical Properties

Depth (cm)	pH (1:2.5)	E.C. 1:2	CaCO ₃ %	O.C. %	NHC %	M.E. %	CSC M. Eq/ 100 g. soil.	Exchangeable Cations M. Eq/100 g.			
								Ca	Mg	Na	K
0-6	8.05	< 0.2	nil	0.37	25.58	-	4.94	3.00	1.00	-	-
6-26	8.4	< 0.2	nil	0.15	27.87	-	5.62	3.00	1.75	-	-
26-40	8.5	< 0.2	3.41	0.18	28.50	-	6.53	4.25	2.00	-	-
40-69	8.6	< 0.2	7.70	0.03	33.17	-	4.90	2.25	2.00	-	-
69-99	8.7	< 0.2	6.82	0.07	32.00	-	4.90	1.75	3.00	-	-
99-120	8.6	< 0.2	10.61	0.12	33.44	-	5.17	4.00	1.00	-	-
120-134	8.7	< 0.2	6.76	0.12	32.62	-	5.44	4.00	1.25	-	-
134-165	8.85	< 0.2	4.95	0.10	33.10	-	4.35	3.75	0.50	-	-

Range in Characteristics : -

16 The colour of the surface soils ranges from light yellowish brown to brownish yellow and texture varies from leamy sand to sandy loam. Sub-soil colour ranges from yellowish brown to strong brown and texture is generally

sandy loam.

Drainage and Permeability -

Well drained to somewhat excessively drained with rapid permeability.

'SERIES C'

These soils consist of very deep, somewhat excessively drained, light yellowish brown to brown soils of sandy loam over sand (with sandy loam to loamy sand surface) occurring on gently sloping lands.

Classification : Member of coarse loamy, non-acid, calcareous, mixed hyperthermic family of Typic Ustorthent.

Typifying Pedon : Very deep sandy loam, virgin land under forest area.

Description of typical soil profile (No. 5 indicated on map) examined in south west towards central line of farm is given below : -

<u>Horizon</u>	<u>Depth (cm)</u>	<u>Description</u>
Ap	0-18	light yellowish brown (10YR 6/4, dry); yellowish brown (10YR 5/6, moist); sandy loam; weak, medium, sub-angular blocky; slightly hard; friable non-sticky and non-plastic; plentiful thin roots; strong effervescence with dilute acid with concretion upto 5% by volume of 0.4-4.0 cm, gradual and smooth boundary.
C ₁₁	18-55	Yellowish brown (10YR 5/6, moist) sandy loam; weak, medium, sub-angular blocky; friable; non-sticky and non-plastic; plentiful thin roots; violent effervescence with dilute HCl; clear and smooth boundary.
C ₁₂	55-101	Yellowish brown (10YR 5/5, moist); sandy loam; weak, medium, sub-angular blocky; friable; non-sticky and non-plastic; many thin and fine roots; few lime concretion; violent effervescence with dilute HCl; clear and smooth boundary.

(contd.....16/.....)

- C₃ 101-128 Yellowish brown (10YR 5/5, moist); sandy loam; weak, medium, subangular blocky; friable; non-sticky and non-plastic; few fine roots; plentiful lime concretions; violent effervescence with dilute HCl; clear and smooth boundary.
- C₄ 128-150+ Pale brown (10YR 6/3, moist) to light brownish grey (2.5Y 6/2); sandy loam; weak medium subangular blocky; friable, non-sticky and non-plastic; strong effervescence with dilute HCl;

PARTICLE SIZE DISTRIBUTION

Horizon	Depth (cm)	Coarse sand%	Fine sand%	Coarse silt%	Fine silt%	Total silt	Clay %
Ap 0-15	0-15	3.23	64.33	10.28	10.33	20.61	7.92
C ₁₁	15-53	0.93	53.65	18.25	15.25	33.50	9.37
C ₁₂	53-101	0.85	57.25	20.00	4.00	24.00	6.2
C ₁₃	101-128	0.75	53.75	27.65	11.35	39.00	7.53
C ₁₄	128-150	1.00	70.00	23.00	4.90	27.90	2.87

PHYSICO-CHEMICAL PROPERTIES

Depth (cm)	pH (1:2.5)	E.C. 1:2	CaCO ₃ %	O.C. %	WHC %	N.R. %	CEC 4.00/100 g. soil.	Exchangeable Cations			
								Ca	Mg	Na	K
0-15	8.65	< 0.2	1.92	0.30	25.17	7.21	5.44	4.00	1.00	0.37	0.17
15-53	8.70	< 0.2	6.76	0.16	26.84	6.97	5.98	4.25	1.00	0.48	0.
53-101	8.80	< 0.2	4.23	0.03	26.49	4.10	4.90	3.75	0.75	0.45	0.06
101-128	8.80	< 0.2	9.46	0.04	25.91	5.74	6.25	4.50	1.25	0.46	0.05
128-150	9.00	< 0.2	2.42	0.09	28.77	3.00	3.80	2.00	1.50	0.33	0.02

Range in characteristics -

The colour of the surface soil ranges from light yellowish brown to yellowish brown and texture varies from sandy loam to loamy sand. Sub-soil colour ranges from yellowish brown to pale brown and texture is generally sandy loam over sand or loamy sand.

Drainage and Permeability -

Well drained to some what excessively drained with rapid permeability.

Use :-

Presently under forest but designed for the Agricultural use. After levelling the crops taken up by the farmers adjoining the area can be taken up. *Grain*

' SERIES D'

Comprises moderately well drained to well drained very deep, calcareous, clay loam of light yellowish brown to yellowish brown colours. They occur on nearly level to gently sloping lands with 1-3% slopes. $CaCO_3$ ^{content} ~~ks~~ ^{STB} increase with depth to the extent being 20 to 40% by volume.

Classification : Member of fine loamy non-acid, calcareous, mixed hyperthermic family of Typic Ustochrept.

Typifying Pedon : Very deep, clay loam, under grass cover.

Description of a typical soil profile (No. 6 indicated on map) examined in south east of the farm is given below : -

<u>Horizon</u>	<u>Depth (cm)</u>	<u>Description</u>
Ap	0-16	Light yellowish brown (10YR 6/4, dry), yellowish brown (10YR 5/6, moist); loam; moderate, medium, sub-angular blocky, structure, slightly hard, slightly firm, slightly sticky and slightly plastic, violent effervescence with dilute HCl, 0.5 to 2 cm irr lar lime concretions upto 10-1 by volume of 0.5 to 2 cm size; many thin and fine roots; clear and smooth boundary.
B ₁₂	16-76	Yellowish brown (10YR 5/6, moist); silt loam; moderate, medium, sub-angular blocky; hard, firm, sticky and plastic; violent effervescence with dilute HCl; lime concretions upto 40 to 50% volume; many fine roots; clear and smooth boundary.

1a

C₁₂ 76-150 Yellowish brown (10YR 5/6; moist); silt loam; medium, moderate, subangular blocky, firm, sticky and plastic; violent effervescence with dilute HCl; irregular lime concretions upto 5-7% by volume; few fine roots.

PARTICLE SIZE DISTRIBUTION

Horizon	Depth (cm)	coarse sand%	Fine sand%	Coarse silt%	Fine silt%	Total silt %	Clay %
Ap	0-16	6.76	44.70	15.30	18.52	33.82	13.80
B ₁₂	16-76	3.71	19.56	33.00	23.50	56.50	20.50
C ₁₂	76-105 76-105	2.50	22.50	30.00	28.50	58.50	18.00

PHYSICO-CHEMICAL PROPERTIES

Depth (cm)	pH (1:2.5)	E.C. 1:2	CaCO ₃	O.C. %	NHC %	M.E.C %	CEC M.eq/100 g. soil.	Exchangeable Cations M.eq/100 g.			
								Ca	Mg	Na	K
0-16	8.65	< 0.2	13.20	0.24	30.15	-	5.98	3.00	1.70	0.80	0.46
16-76	8.90	0.8	20.18	0.12	33.48	-	13.69	4.50	6.75	1.	0.70
76-105	8.40	4.3	12.21	0.13	35.72	-	13.41	5.50	5.50	1.	0.70

Range in Characteristics -

The colour of the surface soil ranges from light yellowish brown to yellowish brown and texture varies from sandy loam to loam. Sub-soil colour ranges from yellowish brown to brown and has generally clay loam texture.

Drainage and Permeability -

Moderately well drained with moderate permeability.

(contd....19.....)

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'SERIES B'

Comprises very deep, moderately drained light yellowish brown to brown soils of highly stratified silt loam to sand (with sandy loam to silt loam surface) on level to nearly level land.

Classification : Member of coarse leamy, non-acid, calcareous, mixed hyperthermic family of Typic Ustorthent.

Typifying Pedon : Very deep, stratified, cultivated / Berseem.

Description of a typical soil profile (No. 7 indicated on map) examined south-east of the farm is given below : -

<u>Horizon</u>	<u>Depth (cm)</u>	<u>Description</u>
A ₁	0-22 - 19	-Yellowish brown (10YR 5/4, moist); silt loam, medium, moderate, subangular blocky; slightly hard, firm, sticky to non-plastic; few fine and thin roots; strong effervescence with dilute HCl; clear and smooth boundary.
C ₁₁	22-44	Yellowish brown (10YR 5/4, moist); silt loam; medium, moderate, angular blocky, slightly hard, firm, sticky and non-plastic; few fine roots; strong effervescence with dilute HCl; clear and smooth boundary.
C ₁₂	44-59	Brown (10YR 5/3, moist) loam; medium, moderate, angular blocky; friable; non-sticky and non-plastic; few thin roots; strong effervescence with dilute HCl; clear and smooth boundary.
C ₂	59-69	Yellowish brown (10YR 5/4, moist) silt loam; platy; firm, sticky and non-plastic, few fine roots; strong effervescence with dilute HCl; clear and smooth boundary.

(contd.....20/.....)

<u>II</u> C ₂₂	69-79	Brown (10YR 5/3, moist) silt loam; sub-angular blocky; friable; non-sticky and non-plastic; many thick and thin roots; strong effervescence with dilute HCl; clear and smooth boundary.
<u>II</u> C ₂₃	79-107	Yellowish brown (10YR 5/4, moist); silt loam; platy; firm, sticky and non-plastic; many thick and thin roots; slight effervescence with dilute HCl; few, fine, faint mottlings; clear and smooth boundary.
<u>III</u> C ₃	107-130	Brown (10YR 5/3, moist) loam, medium, moderate, subangular blocky; friable, non-sticky and non-plastic; many thick and thin roots; slight effervescence with dilute HCl; clear and smooth boundary.
<u>IV</u> C ₄	130-144	Yellowish brown (10YR 5/4, moist) silt loam, highly stratified; firm, sticky and non-plastic; strong effervescence with dilute HCl; many thick and thin roots; common distinct mottlings of 7.5YR 4/4 (brown to dark brown); clear and smooth boundary.
<u>V</u> HIC ₅	144-155	Pale brown (10YR 6/3, moist); sandy loam, weak, moderate, subangular blocky, friable, non-sticky and non-plastic; slight effervescence with dilute HCl; clear and smooth boundary.
<u>VI</u> AHIC ₆	155-165+	Brown (10YR 5/3, moist); silt loam; medium, moderate, subangular blocky; friable, sticky and non-plastic; strong effervescence with dilute HCl; plentiful distinct mottlings of brown to dark brown (7.5YR 4/4).

ANALYTICAL DATA (on next page)

(contd....21/....)

PARTICLE SIZE DISTRIBUTION

Horizon	Depth (cm)	Coarse sand%	Fine sand%	Coarse silt%	Fine silt%	Total silt	Clay %
A ₁	0-22	1.64	16.06	31.50	33.93	65.43	15.07
C ₁₁	22-44	0.69	20.75	32.68	31.25	63.93	17.40
C ₁₂	44-59	-	-	-	-	-	-
R C ₂	59-69	nil	12.80	42.80	27.75	70.55	14.50
R C ₂₂	69-79	nil	24.06	48.60	17.00	65.60	10.25
R C ₂₃	79-107	nil	17.84	36.51	30.75	67.26	14.25
R C ₃	107-130	nil	41.84	36.80	11.00	47.80	10.25
R C ₃₄	130-144	nil	11.29	36.00	37.75	75.75	13.75
R HC ₅	144-155	nil	69.04	20.75	4.50	23.25	6.75
R HC ₆	155-165+	nil	15.00	35.00	36.75	71.75	14.00

PHYSICO-CHEMICAL PROPERTIES

Depth	pH (1:2.5)	E.C. 1:2	CaCO ₃ %	O.C. %	W.C. %	M.E. %	CEC M.Eq/100g soil.	Exchangeable Cations			
								Ca	Mg	Na	K
0-22	9.20	2.1	2.58	0.33	33.20	-	10.34	7.00	1.90	-	-
22-44	8.20	3.0	2.75	0.33	39.51	-	8.00	3.30	2.95	-	-
44-59	8.40	3.0	1.81	0.07	31.32	-	8.79	3.75	3.75	-	-
59-69	8.25	7.0	2.25	0.09	35.71	-	8.60	4.50	2.75	-	-
69-79	8.25	5.0	2.58	0.01	32.16	-	9.25	4.50	2.25	-	-
79-107	8.25	6.5	2.58	0.02	35.00	-	9.25	4.50	2.00	-	-
107-130	8.45	5.0	1.76	0.01	36.25	-	7.12	2.50	1.68	-	-
130-144	8.55	3.0	3.13	0.22	40.00	-	10.82	3.25	5.00	-	-
144-155	8.95	1.1	1.76	0.15	33.56	-	4.90	2.00	1.25	-	-
155-165	8.50	3.8	2.75	0.22	42.29	-	8.70	3.75	2.75	-	-

Range in Characteristics -

The colour of the surface soil ranges from light yellowish brown to yellowish brown and texture varies from sandy loam to silt loam. Sub-soil colour ranges from yellowish brown to brown and texture varies from loam to silt loam.

Drainage and Permeability -

Well drained with moderate permeability.

Use - Barsoom.

(contd.. ...22/....)

4. LAND CAPABILITY UNITS

4.1 Capability Unit II C (Cca) -

Very deep, well drained, highly variable texture on nearly level to level lands with loam to silt loam surface texture. These are by far the best lands on the farm. Under normal rainfall condition they are suited to all climatically adapted crops like Bajra, Guar, Moong, Urd, Moth, Arhar, Jwar and ^{and} ~~Ramsa~~ ^{During} Kharif and Wheat, Barley, Gram, Laha for grain and forage. Mixed cropping with deep roots ^{and} legumes is recommended (Area 4.6 Ha.).

They will respond best to irrigation management and all climatically adapted crops can be grown for grain and forage.

4.2 Capability Unit II S9 (DcB, DcBC) -

Soils of this unit are well drained, fine loamy soils on nearly level to very gently sloping lands with loam surface texture. These soils will present ^{very fine} (problem inherent due to free lime present). Available moisture capacity is good. During Kharif season the soil can hold all the moisture due to precipitation in normal years and can support crops like Bajra, Guar, Moong, Urd, Moth, Cowpea in Kharif and Wheat, Barley for grain and forage. (Area 21.02 Ha.).

Under irrigation a variety of crops can be grown. Mixed cropping will help complementation use of fertiliser N and moisture use. Placement of phosphatic fertiliser for minimising fixation problem is necessary due to the presence of free lime.

4.3 Capability Unit III S 2 (AaA, AaR, AbBC, BbBC and CbBC) :

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Very deep, draughty, coarse loamy soils on nearly level to gently sloping lands with loamy sand to sandy loam surface texture. These are coarse ~~texture~~ soils with low available moisture

capacity. Forage like Bajra, Moong, Cowpea, Moth, Guar, Jwar, Urd during Kharif and Gram forage and Grain During Rabi.
(Area 174.30 Ha.).

Under irrigation a variety of grain and large crops can be grown. But they will need frequent irrigation and split application of N. Fertilizer is necessary to check loss due to leaching. The soils do not present problem of phosphate fixation. Mixed cropping is recommended. It requires levelling for crop production. Bulk manures and green manuring ^{are} recommended.

4.4 Capability Unit III S 9 (AaBC, AbBC, BbBC) :

Soils of this unit are very deep but draughty coarse loamy soils on nearly level to gently sloping lands (complex slope) with loamy sand to sandy loam surface texture. These are calcareous. Available moisture capacity is low. They require levelling for crop production. Crops like Sunhemp, Guar ^{and} Cowpea can be grown.
(Area 49.94 Ha.).

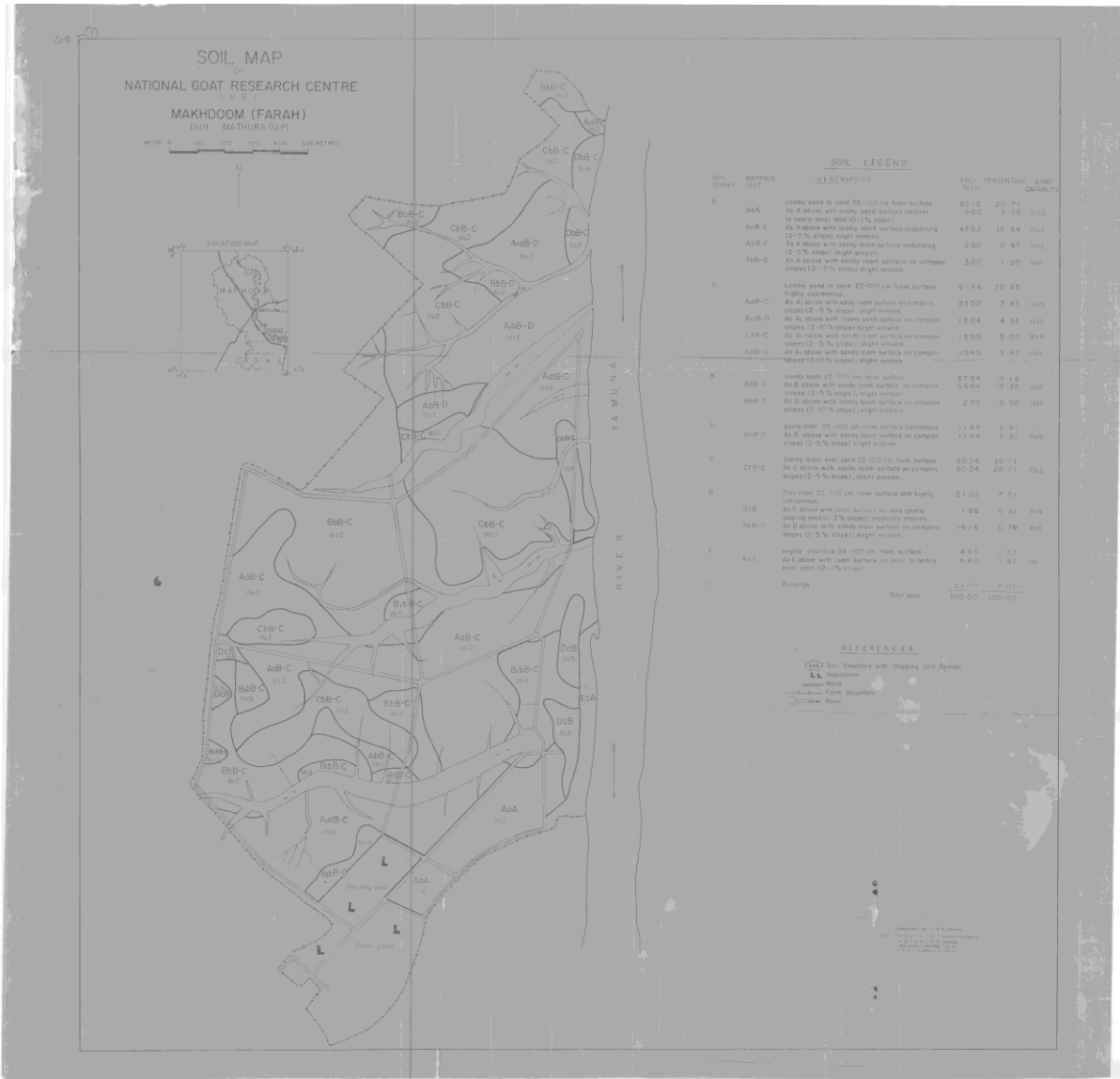
Bajra, Moong, Cowpea, Moth, Guar, Jwar ^{and} Urd during Kharif and Gram for Forage and Grain during Rabi may be ~~are~~ grown.

Under irrigation a variety of grain and forage crops can be grown. But they need frequent irrigation and split application of N Fertilizer is necessary to check loss due to leaching, mixed cropping is recommended.

4.5 Capability Unit IV S1 (AbBD, AaBD, AbBD and BbBD) :

Soils of this unit are well drained, draughty, coarse loamy sand to sandy loam surface texture. These are coarse textured soils with low available moisture capacity.

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These are recommended for growing natural grass ^{and} trees and shrubs. This land may be used for limited open grazing for goats as a source for exercise for the animals.



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