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LAND IRRIGABILITY CLASSIFICATION OF THE SOILS OF HARSIDHI BLOCK UNDER EAST CHAMPARAN DISTRICT OF GANDAK COMMAND, BIHAR

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ABSTRACT: The area under study remained problematic since long. After the introduction of irrigation the condition of the area has improved and the best efforts to find ways and means for proper land use have been made. The soils of the area, exhibiting different characters with varied agricultural practice and irrigational potential have been developed from the sediments deposited by the rivers Sikarana and Gandak. Texturally, the soils of the area are light to medium and rich in potash bur are poor in phosphorous as well as nitrogen. So far irrigability classes are concerned, the major portions of the surveyed areas fall under Class A and B.

INTRODUCTION

Due to increasing pressure of population on land and the introduction of high yielding crop varieties with developing irrigation potential, it has become necessary to introduce some system into all available data with Soil Survey Organisation as well as to collect more data and to subject them to an objective analysis aimed at a comprehensive land irrigability classification. This will help the farmers to take decision for the best permanent use of their lands. The soil irrigability classes are defined in terms of soil properties that express degree of limitation for their development and requirements for irrigational management.

This area forms a part of the vast calcareous alluvial tract of North Bihar lying in the flood plain of the river Gandak. The soils are quite young, very deep, texturally suited to most of the crops and generally moderately well drained to well drained. The land on the whole has high productivity potential. Some of the soils, however, have certain local limitations such as drainage problem, liable to seasonal inundation, undesired permeability which lower their productivity potential (Soil Survery Staff, 1979).

STUDY AREA

The area under study falls in Harsidhi Block of East Champaran district of Bihar State. This area lies between 26° 29' 15" and 26° 42'30" N latitude and 84° 35' and 84° 51'30" E longitude. The area falls under Gandak canal irrigtion system. The total geographical area of the block is 22,945 hectares.

METHODOLOGY

A reconnaissance soil survey of the area at two miles grid was conducted earlier (1963-65) in order to prepare legends for detailed soil survey which was conducted in 1978. For the detailed soil survey the base maps used were cadestral maps on the scale of 16" to a mile and method adopted was according to the proce-

dure laid down in U.S.D.A. (1969) Soil Survey Manual. Some minor modifications, however, were adopted to suit the local conditions. Laboratory determinations were made by standard methods as suggested in text books written by Dastane (1967), Piper (1950) and Jackson (1958).

The important limiting properties of soils determining the irrigability classes are effective soil depth useful to crops, texture of surface layer upto 30cm, soil permeability and hyderaulic conductivity, water holding capacity to a depth of 90 cm, percentage of coarse fragments, presence of gravels and kankars, salinity hazards, depths of water table (Satyanarayana *et al.*, 1958). All these factors were properly considered in deciding the correct irrigability classes. All these factors are represented by symbols, the details of which are as follows:

(I) **Effective depth :** Harsidhi block falls in the alluvial tract of North Bihar. These soils are very deep without exception and hence depth is not a limitation in the use of these soils.

(II) **Texture of surface soils :** Four textural classes have been followed as given below.

Symbol	Explanation	Description
H	Heavy	Silty clay loam to clay loam (on heavy side)
M	medium	Loam to clay loam (on lighter side)
S	Moderately	Sandy loam to sandy silt.
L	Light	Loamy sand to sand

(III) **Hydraulic conductivity and permeability :** In the field, permeability was assessed by observing texture, structure, mottlings and root penetration. It was confirmed in the laboratory. Hydraulic conductivity was also determind. These determinations were done for the surface layer and the substratum. The following classification have been followed :

S.N.	Explanation	Description (percolation rate in cm/hr)
1.	Very slow	less than 0.15
2.	Slow	0.15 to 0.45
3.	Moderately Slow	0.45 to 1.0
4.	Moderate	1.0 to 1.5
5.	Moderately rapid	1.5 to 2.5
6.	Rapid	above 2.5

(IV) **Slope:** The slope percentage was measured witht he help of hand Abney level. The following classes have been used.

Symbol	Explanation	Description
A	Nearly level	0-1%
B	Gently sloping	1-3%
C	Moderately sloping	3-5%

(V) **Erosion :** The classes under erosion are grouped upon the degree of sheet erosion. The average depth of top soil in uneroded areas has been taken as 25cm, and so the calculation of erosion loss is on this basis. It was possible to measure the depth of the top soil by distinguishing characteristics. The classes are given here :

Symbol	Explanation	Description
1.	None or slight	Less than 25% of top soil lost
2.	Moderate	25% to 50% of top soil lost
3.	Severe	50% to 75% of top soil lost
4.	Very severe	More than 75% or all the top soil lost.

(VI) **Salinity :** The concentration of soluble salts is a limiting factor in land use, particularly under irrigation farming. The electrical conductivity of the soils studied was belowe 4 mmhos/cm, hence salinity did not appear to be a limiting factor in the area surveyed.

(VII) **Soil reaction (pH) :** As the soils of the area are highly calcareous hence the pH is expected to be high. In a few cases, however, the pH is a bit above 8.5 which suggests the potentiality of sodicity.

In such cases use of organic and inorganic soil amendments with improvement in drainage are essential.

(VIII) **Physiography :** The phsiography of the area plays a dominant role in its uses and the soil character. The symbols for physiography are as follows :

Symbol	Explanation
U	Unland
M	Medium upland
L	Lowland

(IX) The criteria for differentiating soils into different irrigability classes are given below:

Criteria for classifying soils into irrigability class
(classes which are applicable in the area)

Soil properties	Irrigability soil class		
	A	B	C
Effective soil depth	More than 90cm	45-90cm	22.5-45cm
Texture of surface 30cm	Sandy loam, clay loam	Loamy sand, clay	Sand, clay
Soil permeability of lowest permeable layers.	5-50mm/hr.	1,3-5mm/hr. 50-130/hr.	0.3-1.3mm/hr. 130-25mm/hr.
Water holding capacity up to a depth of 90cm.	12cm or more	9-12 cm	6-9cm
Gravel and Kankars% (25 to 75mm)	Less than 15%	15 to 35%	35 to 55%
Salinity E.C. x 10^3 of saturation extract mmhos/cm	Less than 4	4-8	8-12
Salt affected (Visual% of area affected).	Less than 20%	-	-
Depth of water table (during rains/during summer.	7.5m/16.5m	3.5m/16.5.5m	1.5m-3m/ 5-10m.

The soil series of the area: The soils of this area, considering its profile characteristics, depth, surface, texture, hydraulic conductivity and permeability, pH and chemical characteristics were categorised into soil series and types as taxonomic units. Thirteen such soil series have been observed in this block, The main soil properties of these series are tabulated in table 1 and 2.

Table 1

Physical soil properties of soil series found in the area

Name of soil series	1-Surface 2-Sub-surface 3-Substratum	Range in Texture	Bulk density in gm/cc	Hydraulic conductivity cm/hr	Permeability $25x10^{-10}$ in cm/sec.
1	2	3	4	5	6
1. Bajarmara	1	sL	1.48	0.927	$2x10^{-9}$
	2	ssi	1.39		
	3	sis to ssi(H)	1.32	0.695	$17x10^{-10}$
2. Balwa	1	sL	1.34	3.97	$99x10^{-10}$
	2	siL to sicl	1.33		
	3	siL to Cl	1.56	2.08	$5x10^{-10}$
3. Barariha	1	sis	1.36	12.05	$3x10^{-8}$
	2	SL to sis	1.33		
	3	sis to siL	1.33	7.09	$17x10^{-8}$
4. Bishunpurwa	1	sisL	1.39	2.12	$5x10^{-9}$
	2	siL	1.37		
	3	Cl to ssi (L)	1.40	5.94	$4x10^{-9}$
5. Bishunpur	1	ssi	1.38	6.72	$16x10^{-7}$
	2	sis to siL	1.34		
	3	siL	1.36	3.29	$5x10^{-10}$
6. Dharmuhan	1	SL	1.42	0.113	$2x10^{-10}$
	2	siL	1.58		
	3	sis	1.43	0.278	$6x10^{-10}$
7. Hathuawa	1	S	1.37	0.593	$14x10^{-10}$
	2	S to sis	1.38		
	3	sis to S	1.31	1.372	$34x10^{-10}$
8. Korigawar	1	ssi	1.38	0.445	$8x10^{-10}$
	2	sis to sicL	1.30		
	3.	siL to sicL	1.39	0.363	$2x10^{-10}$
9. Matiharia	1	ssi	1.62	0.445	$11x10^{-10}$
	2	sis to sicL	1.42		
	3	siL to sicL	1.53	0.363	$9x10^{-10}$

1	2	3	4	5	6
10. Paharpur	1	siL	1.42	3.600	$9x10^{-9}$
	2	ssi to siL	1.40		
	3	siL ro sicL	1.40	2.770	$60x10^{-10}$
11. Sautpur	1	siL	1.37	1.112	$2x10^{-9}$
	2	ssi to sil	1.60		
	3	ssi to siL	1.67	0.373	$9x10^{-10}$
12.Sera	1	sL	1.37	1.48	$3x10^{-10}$
	2	siL	1.64		
	3	ssi to S	1.62	0.973	2x10-9
13. Turkaulla	1	siL	1.30	0.363	$9x10^{-10}$
	2	siL to sicL	1.45		
	3	siL	1.45	0.352	$8x10^{-10}$

sl= Sandy loam; ssi = sandy slit; (H) = Heavy; sis- silty sand siL= slit loam;
sicl= silty clay loam; cl = clay loam; (L) = Light; S= Sand

Table -2

Chemical soil properties of soil series found in the area

Name of Soil series	1- Surface 2- Subsrface 3- substratum	calclum carbonate %	pH	E.C. in saturation soil water extract mmhos/cm	Organic Carbon %	Organic N%	Average P_2O kg/ha.
1	2	3	4	5	6	7	8
1. Bajarmara	1	34.1	8.6	2.040	0.51	0.051	54
	2	34.2	8.3	2.032			
	3	33.2	8.3	2.008			
2. Balwa	1	36.0	8.2	0.672	0.39	0.039	85
	2	36.0	8.1	0.484			
	3	34.0	8.0	0.524			
3.Barariha	1	34.0	8.8	0.880	0.431	0.043	84
	2	35.0	8.3	1.552			
	3	34.0	8.1	0.984			
4. Bishunpurwa	1	32.0	8.3	2.772	0.43	0.043	76
	2	30.0	8.1	1.644			
	3	32.0	8.0	1.380			

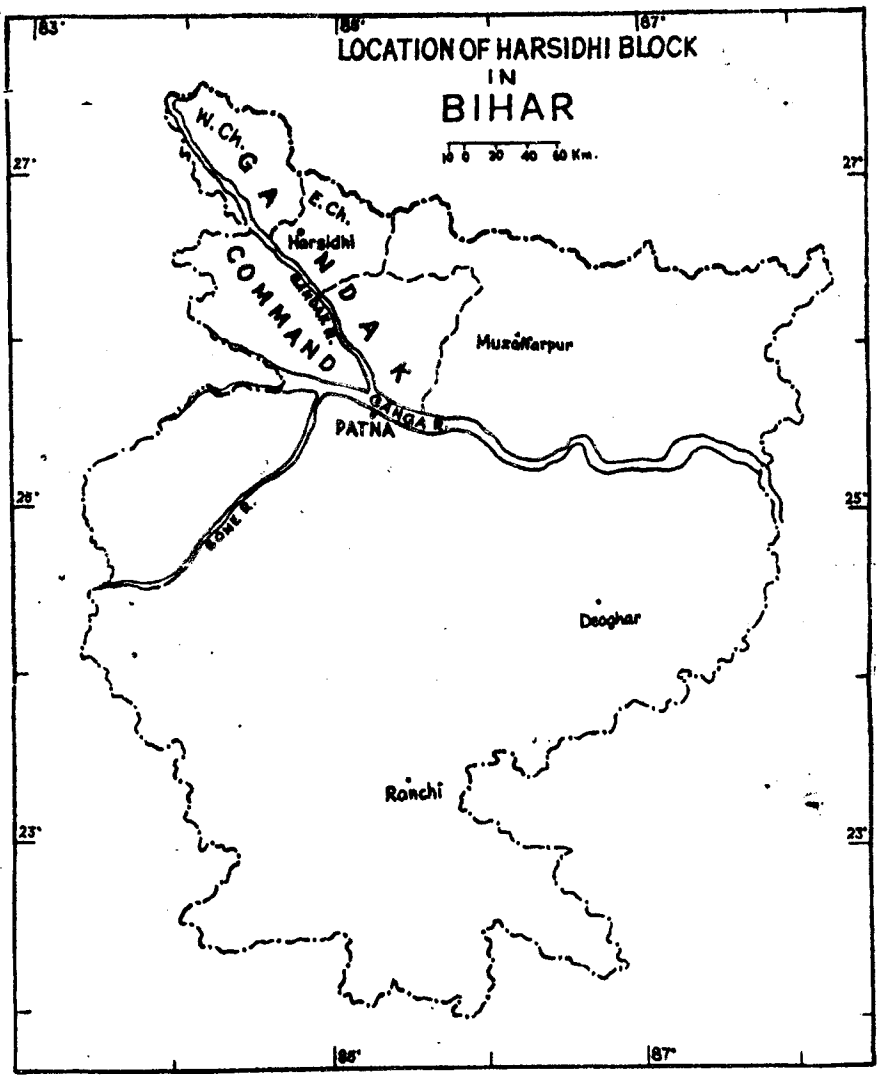
1	2	3	4	5	6	7	8
5. Bishunpur	1	36.0	8.0	0.896	0.490	0.049	92
	2	36.0	8.1	0.792			
	3	35.0	8.2	1.008			
6. Dharmuhan	2	43.3	8.7	2.160	0.54	0.054	69
	2	42.3	8.5	2.094			
	3	43.2	8.3	2.040			
7. Hathuawa	1	44.4	8.6	2.240	0.40	0.057	69
	2	42.3	8.5	2.144			
	3	43.2	8.4	2.048			
8. Korigawar	1	33.5	8.5	2.128	0.48	0.048	54
	2	32.0	8.3	2.098			
	3	34.4	8.4	1.728			
9. Matiharia	1	46.2	8.8	1.792	0.42	0.042	70
	2	48.2	8.4	1.724			
	3	44.9	8.3	1.780			
10. Paharpur	1	36.0	8.7	1.164	0.331	0.035	65
	2	37.0	8.3	3.040			
	3	31.0	8.2	2.872			
11. Sautpur	1	40.2	8.7	2.280	0.49	0.049	72
	2	39.8	8.4	2.152			
	3	39.0	8.3	2.084			
12. Sera	1	38.0	8.6	2.164	0.55	0.055	70
	2	35.0	8.3	2.152			
	3	36.5	8.3	2.124			
13. Turkaulia	1	29.4	8.5	1.792	0.48	0.048	70
	2	28.0	8.5	1.752			
	3	29.4	8.3	1.792			

LAND IRRIGABILITY CLASS E5

As mentioned earlier all the soil properties for deciding land irrigability classes have been considered which suggest three irrigability classes, as shown in map no. 1 snd are briefly described below:

Soil irrigability class A: In this class the soils are deep,medium textured, well drained to moderately well drained, almost free from salt effects and have moderate to moderately slow permeability.

The soils of this class are found mainly in Sautpur, Paharpur Turkaulia and Bishunpurwa series occuping nearly 4835 hectares of the land which becomes 21.07% of the total area surveyed.



Soil irrigability class B: Though the soils of this class are also well suited to irrigation but they have one or more moderate type of limitations like heavy texture, slow or moderately rapid permeability. The water table in some cases is slightly high. This class of soil is commonly found in every series and occupies 13,344 hectares of land which accounts for 58.59% of the total area surveyed.

Soil irrigability class C: The soils of this class have some severe limitations as compared to class A and the soils are poorly suited to irrigation. The soils of this class are no doubt deep but have either sand or heavy texture or have compact layers. Either the permeability is slow or rapid and in many cases the drainage is moderately slow to slow. In many cases water table is high.

The soils of this class are mainly observed in Hathuawa series and cover an area of 4,666 hectares which comes to 20.34% of the total area.

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