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**procedure
for
conducting
standard
soil
survey**

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**Procedure for
Conducting Standard Soil Survey**

**DEPARTMENT OF AGRICULTURE
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FOREWORD

Soil Survey is one of the essential prerequisites for scientific planning of Agriculture. The main object of Soil Survey is to assemble all possible information of the land resources and present the data thus collected in a suitable form. Its utility in soil conservation planning is unquestionable.

In Maharashtra State Soil Surveys were being carried out for a considerable period, in a scattered manner with some specific objects only. However there remained a lacuna of regular state-wide soil survey for all purposes. This lacuna has now been overcome, with the launching of the new Soil Survey Scheme with the main object of land use planning.

In order to achieve this object, villagewise soil survey would be ideal, as it would fetch a sort of Agricultural Atlas of the village. But it is very expensive and may require very long period for completion of work. Hence it is proposed to survey an area of about 3,000 acres from a village or two at a grid interval of 10 miles. Thus an average of 50 to 60 villages will have to be surveyed per district.

A survey party is proposed for each district and thus there are 25 soil survey parties. Each party is expected to survey about 30,000 acres from 10 to 12 villages per year. Thus about 7.5 lakh acres from about 250 villages would be covered each year. Accordingly the proposed State plan would be completed in about 6 to 7 years.

There is a Soil Survey Officer for each division and he is to be provided with a well equipped laboratory and drawing branch. In addition a central laboratory has been proposed for the Chief Soil Survey Officer, who is to co-ordinate their work.

The programme of Soil Survey is to be planned and developed in successive stages. In order to carry out soil survey work on such a large scale, it is needless to stress the importance of adopting uniform method of survey and standard pattern of mapping. Any survey without uniformity of method is practically of a little use. Hence to achieve uniformity "the procedure for conducting Soil Survey" has been laid out wherein field examination of soil and recognition of various soil characteristics have been explained. The system of nomenclature and use

of symbols etc. has been kept as far as possible similar to one proposed in soil survey manual prepared by I. C. A. R. in 1960. The procedure for Soil Survey in Maharashtra State has been compiled by Shri K. V. Joshi, Chief Soil Survey Officer on the basis of one which he had originally prepared for sugarcane soil survey in 1957.

I am sure that this procedure of survey will not only be useful for actual field survey workers, but also to the students of agriculture.

Poona-1,

Dated: 27th November, 1966.

M. B. GHATGE,
Director of Agriculture,
Maharashtra State.

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Procedure for Conducting Standard Soil Survey

CHAPTER I

OBJECT OF SOIL SURVEY

1. Object of Soil Survey

The main object of all soil surveys is to assemble all possible information of the land resources and present the data thus collected in a suitable form. The ultimate aim of the soil survey is to give necessary recommendations for land use planning, which may be helpful for scientific development of Agriculture. The standard soil survey is expected to provide necessary technical data required for various phases of development and harnessing the land resources. The recommendations in respect of the following aspects of land use planning are proposed under this scheme of standard soil survey :

- (i) Soil and Water Conservation
- (ii) Soil Fertility
- (iii) Soil Reclamation
- (iv) Development of Waste Land
- (v) Watershed Planning.

2. Plan of Work

In order to achieve the object of the scheme, village-wise survey would be ideal as it will fetch a sort of 'Agricultural Atlas' of the village. But it may be very expensive and a very long period will be required for the completion of work. It is therefore, proposed to adopt a suitable grid pattern for undertaking this survey all over the State. A ten mile grid will be adopted in case of rather plain areas. However, in case of hilly areas of high rainfall zone, the grid interval is proposed to be kept at five miles. This grid pattern will be shown on State map, more or less mechanically by drawing parallel lines to North line. Similarly, cross lines will also be suitably drawn at 10 miles interval. The villages falling at these grid spots will be selected for survey. Normally, about 3,000 acres comprising of one or more villages will be surveyed at each grid

spot. Certain amount of flexibility in selection of village will be necessary to suit the local conditions.

On the basis of 10 miles grid pattern, there would be about 1,500 villages located in all the 25 districts. Thus, on an average, 50 to 60 villages will have to be surveyed per district. Each survey party is expected to survey minimum 30,000 acres scattered over 10 to 12 villages. The total outturn of all the 25 parties per year would be 7.5 lakh acres from about 250 villages. With these targets, the entire State will be completed within a period of 6 to 7 years. In short, the plan of standard soil survey work envisaged is as below:—

- (a) State level ...1,500 villages covering an area of about 45 lakh acres.
- (b) District level ...50 to 60 villages covering an area of about 1.8 lakh acres.
- (c) At village end ...One village or more at an interval of 10 miles grid covering an area of about 3,000 acres.

The Chief Soil Survey Officer, will prepare a map of Division, and districts showing the 10 miles grid and supply the same to Soil Survey Officers of the Division. The Divisional Soil Survey Officer should arrange to get this grid superimposed on the district map of a scale 1" to 2 Miles, and fix the villages for the soil survey in consultation with Chief Soil Survey Officer.

3. Stages of Development

The programme of soil survey has to be developed in successive stages. In the first instance, all the available information regarding the area to be surveyed, such as climate, geology, topography, agricultural practices soils etc., is to be assembled at one place and carefully examined to see the physiographic divisions possible in the region. This information is to be supplemented by field surveys. On the basis of the information, a broad soil map of the area is to be prepared. This would be followed by the detailed soil survey of the selected area and collection of grid samples and examination of profiles and collection of horizon-wise samples of the same.

Thus the technical work envisaged would be carried out on the following broad lines :

- (i) Collection of preliminary information of the area to be surveyed such as climate, rainfall pattern, geology, topography, major crops, agricultural practices, water resources etc.
- (ii) Field soil survey involving detailed observations at the grid spot, and collection of grid samples and preparation of soil variation map.
- (iii) Location of profile spot to be fixed and then to examine the soil profiles morphologically and collection of profile samples horizon-wise.
- (iv) Examination of soil samples collected in the laboratory for physico-chemical properties.
- (v) Preparation of various soil maps delineating different characteristics of soil viz. :—
 - (a) Base map of the village showing the location of grid and profile sample spots and landscape indicating topographical features.
 - (b) Soil type and key map showing distribution of soil types and indicating the soil attributes by key letters.
 - (c) Land capability maps showing the distribution of areas under different classes.
 - (d) Land suitability for different types of irrigation indicating development programme necessary for the same.
- (vi) Preparation of report of the survey work done for each village.

4. Detailed Procedure for Survey Work

In order to carry out the soil survey work on such a large scale it is needless to stress the importance of adopting uniform method of survey and standard pattern of mapping. Any survey without uniformity of method is practically worthless. In

order to attain this uniformity, the surveys should be carried out on a systematic basis laid out for the purpose, and there should also be all possible uniformity in the system of nomenclature, description, use of symbols etc.

For this purpose it is proposed to adopt as far as possible the procedure and symbols etc., as suggested in the Soil survey Manual Prepared by I. C. A. R., in 1960 with slight modifications wherever required to suit to our conditions.

A map of the village selected for survey on the scale $1'' = 660'$ or $1'' = 330'$ is collected. On this map, a grid plan of 1:320 is superimposed by taking longest straight line of any survey number or any group of survey number having one straight line as their border. The grid spot will be staggered by taking an alternate parallels of grid line (as shown in rough sketch). This will result in well distributed plan of grid spot for field studies of soil. At each grid spot, observations will be taken at 3 to 5 places within the vicinity of about $110'$ and the information will be recorded in specific form and also shown on the map with necessary symbols. While moving from one spot to another, information of the surface features of the soil should also be noted survey number-wise in the field book.

Surface Features

(1) *Locality of the grid spot.*—The name of village, survey number etc. may be mentioned. Similarly, grid number given should also be mentioned.

(2) *Location of grid spot with reference to general relief conditions* such as—(i) on higher elements of relief, (ii) on slope, (iii) intermediate on sloping land, (iv) on plain and (v) in depression or lower elements of relief should also be suitably mentioned.

(3) *Land scape or Relief.*—The general topographical feature should be noted, and presented by following symbols on the map. In addition, percentage slope could also be worked out by using Abney level. This information will be useful in

showing the type of development work needed to make the land suitable for irrigation:

| Nature of relief or Land scape | Syn bol to be used on map | Degree of slope | Symbol to be used |
|---|---------------------------|-----------------|-------------------|
| 1. Plain area ... | — — | Less than 1 % | (A) |
| 2. Gently sloping or plain sloping area ... | — → | 1 to 3 % | (B) |
| 3. Rolling plain areas. | —s → | 3 to 8 % | (C) |
| 4. Steeply sloping areas. | — → | 8 to 15 % | (D) |
| 5. Very undulated gullied ravine areas. | s s → | More than 15 % | (E) |

* The arrow point shows the direction of general slope.

The degree of slope should be measured by Abney level and reading in degrees may be converted into percentage slope by formula $100 \tan \theta$. (The use of Abney level and table of natural tangents and gradient percentage may be referred).

(4) *Erosion*.—Degree of erosion should be closely observed and noted on the basis of lighter shade of colour of surface soil, and sizes of the concretions such as grit, lime nodules, and their preponderance in the surface layer and general topographical features. The following erosion classes are suggested and symbol to be adopted is mentioned against the same:—

- | | |
|----------------------------|----------------|
| (a) None to slight erosion | e ₁ |
| (b) Moderate erosion | e ₂ |
| (c) Severe erosion | e ₃ |
| (d) Very severe erosion | e ₄ |

Extent of erosion may be mentioned such as—local/extensive.

(5) *Drainage condition*.—Drainage condition as to whether good, bad, restricted etc., may be noted. If there is any well in the locality nearby the grid spot, the depth of water table and the quality of water may be noted. Similarly, the seasonal

fluctuations in water table may also be ascertained. The following drainage classes and their symbols are given below:—

- | | | | |
|-------------------------|-----|----------------|---|
| (a) Poorly drained | ... | D ₁ | As judged from salt incrustation and vegetation. |
| (b) Imperfectly drained | ... | D ₂ | As judged from karliness and delay in time taking to come to 'wapsa' condition. |
| (c) Moderately drained | ... | D ₃ | As judged from karliness and delay in time taking to come to 'wapsa' condition. |
| (d) Well drained | ... | D ₄ | As judged from short time, taken for achieving 'wapsa' condition. |
| (e) Excessively drained | ... | D ₅ | Lightness and opened structure of soil. |

(6) *Natural Vegetation.*—The list of the plants, trees and grasses, naturally growing in the areas may be noted and their local names together with vernacular names may be given. In case of any difficulty in identification of plant species, a sample of the same may be properly collected and got identified through the Professor of Botany of the college. Natural vegetation is an important guide to recognise soil characteristic, depth of water-table, degree of salinity, depth of soil and drainage condition could also be ascertained from these observations. It is a general observation that *Tridax* and *Argemone Mexicana* weeds grow well in open textured and well drained shallow soils. Shendi palm, Toddy palm, babul weeds, pankanis etc., seen in water logged and saline soils. Some xerophytic weeds like 'cactus', wild 'castor', *taravad*, *pisola*, *danati*, etc., are associated with erroded deep soils.

(7) *Parent Material.*—Nature of underlying rock and the degree of the weathering of the same may be noted in case of soils formed in situ, while in case of deposited or transported material, the sources may be mentioned. The nature of sub-strata such as soft, friable, hard murum etc., may be noted since it gives the idea of drainage condition of sub-strata.

(8) *Present Land Use.*—If the profile or grid spot falls in a cultivated field, the name of the crop may be noted. If it falls in fal-

low area the name of the previous crop may be noted. The land use in general may be indicated by the following symbols:—

| | | | |
|----------------------------------|-----|---|----------------|
| Thin Forest | ... | — | F ₁ |
| Moderately dense forest | ... | — | F ₂ |
| Dense forest | ... | — | F ₃ |
| Cultivated cropped land single | ... | — | C ₁ |
| Cultivated double cropped land | ... | — | C ₂ |
| Waste land fit for cultivation | ... | — | W ₁ |
| Waste land unfit for cultivation | ... | — | W ₂ |
| Pasture | ... | — | P |
| Shrubs and Thorny hess and weeds | ... | — | T |
| Plantation | ... | — | PL |

CHAPTER II

SURFACE-SOIL CHARACTERISTICS

1. Soil Colour

Soils show many variations in colours and it is one of the important surface soil feature. Strict uniformity in naming the soil colour should be followed. According to the nomenclature of Munsell-colour chart, an extract in the form of triangular colour chart has been prepared which may be adopted for uniformity in observation. (Triangular colour chart with Munsell colour numbers). For the sake of convenience, the soil colours of common occurrence in our State only with corresponding Munsell colour number are given below:—

| | | |
|-----------------|-----|--|
| Reddish | ... | 2.5 YR, 4/6. |
| Reddish brown | ... | 5 YR, 4/3. |
| Brown | ... | 7.5 YR, 5/4. |
| Dark Brown | ... | 7.5 YR, 4/4 or 10 YR, 3/2. |
| Black | ... | 10 YR, 2/1. |
| Gray Black | ... | 10 YR, 5/1, or 10 YR, 4/1. |
| Gray | ... | 10 YR, 6/1. |
| Light Gray | ... | 7.5 YR, 7/1, or 7.5 YR 6/1. 10 YR, 6/1 or 10 YR, 7/1. |
| Whitish | ... | 10 YR, 7/1 or 7.5 YR, 8/2. |
| Yellowish Gray | ... | 2.5 YR, 6/4. |
| Yellowish | ... | 10 YR, 7/6. |
| Yellowish brown | ... | 7.5 YR, 6/8 or 10 YR, 5/8. |
| Light brown | ... | 2.5 YR, 6/4. |
| Gray brown | ... | 10 YR, 5/2. |

Impeded drainage or poor sub-surface drainage results in mottled colour patterns. Hence colour of mottling may specifically be mentioned. Colour of soil may be noted when dry as well when soil is moist.

2. Soil Texture

The term soil texture is used to express the physical composition of the soil with different sized particles. Soils with preponderance of fine particles are clays or heavy textured soils. Soils with preponderance of coarse particles or sand are sandy soils or light soils. The important textural classes, their signifi-

cance in the field, and their symbols are detailed below. While studying the texture of the soil in the field, it is essential to rub the moist soil in between the fingers.

| S. No. | Textural class | Recognition in the field | Symbol to be used |
|--------|-----------------|--|-------------------|
| 1. | Sandy | Chiefly consists of large grain of sand, when rubbed between the fingers gritty to feel. The particles do not adhere to each other. | S |
| 2 | Sandy Loams. | Composed chiefly of fine sand and other grains of small size, Gritty to feel, but grains adhere together to a slight extent. | SL |
| 3 | Sandy Clays ... | Composed of particles of all sizes sand and clay predominant, gritty to feel yet sticky also. | SC |
| 4 | Loams ... | Composed of uniform mixture of all fine sized particles. Feel moderately smooth. Particles adhere together. | L |
| 5 | Clay Loams... | Chiefly composed of fine particles, silt and clay, sticky when moist, and can be moulded to any shape. | CL |
| 6 | Clays ... | Preponderance of fine particles, clay greasy to feel when moist and sticky also. Wires would be drawn from moist soil. In case of alkaline soil, the soapy feel is worth noting. | C |
| 7 | Silt Loam ... | Mostly consist of fine silt and sand particles, feel smooth when wet but not sticky. | Sil |

3. Soil Structure

Soil structure refers to the arrangement of soil particles in aggregates. The aggregation of primary soil particles is called the soil structure. It is an architecture of soil and mostly depends on fine soil particles, organic matter, Ex. bases in the soil complex and micro flora and funa in the soil. Great importance is attached to the study of soil structure in the field as it has great influence on soil management practices and moisture relationship of the soil. It also reveals many conditions under which it has been formed. Important structural patterns, their description and presentation by symbol is given below:—

Characteristi. and significance

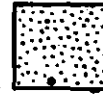
Symbols

Presentation
in profile or
sketch

Structural pattern

Lack of structure in the soil is due to low content of binding material such as clay and organic matter. Soil particles are not bound together and are not also stable when moistened. Typical structure of sandy soils.

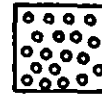
Stl






1. STRUCTURELESS OR
- SINGLE GRAINED.

The soil particles may be formed into aggregates of varying sizes and pulverulent or friable in nature. This may be called as finely granular granular etc., depending on the size of the granule. This is a characteristic structure of the surface layer of normal black soils indicating predominance of Calcium in the clay complex.

Grn

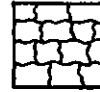


2. CRUMB OR GRANULAR.

| Characteristic and significance | Symbols | Presentation in profile or sketch | Structural pattern |
|---|---------------------------|---|---|
| <p>This structure is similar to large granular or crumb structure, but presents sharp corners rather than rounded one, as in case of nuts or crumbs. Hence the peds are called angular clods. This structure is typical of heavy textured soils low in organic matter.</p> | <p>Ang or Frg</p> |  | <p>3. FRAGMENTED OR - -ANGULAR.</p> |
| <p>In this case, peds are of nut size and are developed along the vertical axis. These peds are hard and stable even when moistened. It is typical structure of the surface layer of 'Karl' soils.</p> | <p>Gnt</p> |  | <p>4. NUTTY STRUCTURE.</p> |
| <p>Larger aggregates developed rather irregularly on all the axis are termed as clods. They may be small, medium or large. They may break up in to smaller aggregates such as fragments, crumbs or nuts. Very big clods are called as blocks and the structure may be termed as Blocky.</p> | <p>Cld</p> |  | <p>5. CLODDY.</p> |

In this structure, the aggregates are arranged in columns and developed along six sides. The angles are fairly well defined and the tops of prism are generally flat. This is a characteristic structure of alkali soils and is also observed in illuvial horizon of light soils i.e. sandy loams and sandy clays etc. The prisms are also classed as small, medium or large according to their sizes.

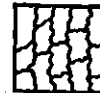
Prm



6. PRISMATIC

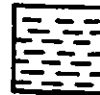
This structure is similar to prismatic structure but without distinct corners. The sides and tops are rounded in this case. This is a typical structure noticed in alkali sandy clay textured soils and leached soils.



Clm

7. COLUMNAR -
STRUCTURE.

The structure is formed along the horizontal axis. The aggregates are wider than their thickness. The horizontal planes or cleavages are more developed in such structure. This is characteristic structure of the deposited river border silty soils.

Plt

8. PLATY OR -
LAMINATED

| Characteristic and significance | Symbols | Presentation in profile or sketch | Structural pattern |
|--|------------|---|---------------------------------|
| <p>This is a similar structure to platy but the development of aggregates is not exactly on horizontal axis but is slightly oblique. It gives appearance of foliation. It is a characteristic structure of the sub-soil of black soils. The reason of formation may be attributed to leaching of B. C. soils under favourable drainage conditions. The intermediate shining appearance indicates the passage of sub-soil water through the soil. These shells are oblique indicating the movement of sub-soil water in that direction.</p> | Shl Lex |  | 9. SHELLY OR LENTIL. |
| <p>When the soil is in a cohesive mass and presents no structure but can be moulded to any shape or form, the structure is called as massive or amorphous or dense. This is the structure generally seen in sub-soil of illdrained soils. This is also characteristic structure of accumulation zone where clay and salt retain more moisture and turn the soil plastic.</p> | Msv |  | 10. MASSIVE OR - -AMORPHOUS. |

4. Consistency and Density

Compactness or looseness of the soil layers in their natural state relates to the consistency under varied moisture conditions. Consistency refers more or less to the permeability of soil layers. It also refers to the physical condition of soil such as friability, stiffness, softness, stickness, compactness, etc.

The moisture status at the time of observation should be noted as saturated, very moist, moist, slightly moist, dry, very dry, etc. to indicate the moisture status at which the consistency observations were made. Important consistency classes with reference to moisture contents are given in the table below:

| Wet soil | | Moist soil | | Dry soil | |
|-----------------|-----|----------------------|------|-------------------------|-----|
| Non sticky | wso | Loose | ml | Loose | dl |
| Slightly sticky | wss | Friable | mfr | Soft & friable | ds |
| Very sticky | wvs | Firm or Compact | mfi | Slightly hard & Compact | dsh |
| Plastic | wp | Very firm or compact | mvfi | Hard | dh |

5. Roots Distribution

If the roots are noticed in the profile and grid pit, their spread and size may be noted such as fine roots, profused roots, a few surface roots, hairy roots, etc. Depth of penetration of roots may also be studied.

6. Concretions

Presence of concretions of lime, iron, silica and such others may be tested and their sizes noted. The content of the carbonates of lime, may be roughly estimated by strength of effervescence. The reaction with HCl may be noted such as strong, moderate, slight etc. The size of concretion and their distribu

tion may be indicated suitably. The amount of degree of HCL reaction may be shown by following symbols:—

| Concretion | | Reaction to HCL |
|------------|--------|--|
| Lime | ... Ca | Slight effervescences. |
| Iron | ... Fe | Moderate effervescences. |
| Silicious | ... Si | Strong effervescences. Very strong or even violent or vigorous. |

7. Miscellaneous

If field testing kit is available, then the observation on soil pH and soil conductivity may be taken. In case the kit is not available, the collected soil samples should be immediately tested for these properties when they are received in the laboratory. Other observations such as stoniness, salt efflorescences at the surface should be made and properly noted.

All the information regarding survey numbers, observation at grid spots may be suitably recorded in the field book and grid observation register. (The pro forma field book of grid register may be seen in the accompaniment). The grid sample collected should be properly labelled. The labels may be written in by copying pencil. One sample chit may be put in the bag and village and grid number may be mentioned on the bag itself. (The form of the sample chit is prescribed).

CHAPTER III

SOIL PROFILE STUDIES

Soil profile is a vertical section of soil which gives an expression to all processes of soil formation, including physical and chemical weathering and vertical translocation of soil constituents by water movement. In systematic soil survey and classification, profile studies assume a special significance because without this study soil classification is not possible. The law of development of soil type by the influence of climate is the main basis of soil classification. The character of soil profile is thus governed by climate. The soil climate itself is also in turn governed by topography and drainage condition.

In order to recognise a soil unit in the field, a soil surveyor has to be familiar with the profile characteristics through which the soil unit is defined and to know how to distinguish different soil units from one another. The soil profile symbolises the phase of soil reflecting its past and present condition. A profile consist of three horizon, viz.:—

| | | |
|-----------------|-------------------------------|--|
| "A" Horizon ... | Eluvial horizon | The horizon from which soil constituents migrate. |
| "B" Horizon ... | Illuvial horizon | The horizon which receives the migrated soil constituents. |
| "C" Horizon ... | Parent material or sub-strata | from which soil is formed. |

CHAPTER IV

HOW TO PREPARE AND DESCRIBE A PROFILE

After detailed reconnaissance of the area, a suitable site presenting normal conditions prevailing in the area is selected for profile study. The profiles are taken on catena basis and on surface soil variations. A rectangular pit to a depth of murum is excavated for exposing the soil profile. The sides of the pit are made exactly vertical. While digging the pit, care should be taken to expose the vertical face to sunlight, and soil excavated from the pit should be thrown away on one side in lots according to soil depth. Each foot depth soil, should be separately heaped. Normally a size of the pit is taken as 4' x 4' and excavated to a depth of murum. In case of shallow soil this size could be kept at 3' x 3'. However, in case of very deep soils, the pit size may be extended to 5' x 5'. Profile is dug up to 5' depth if murum is not reached up to that depth.

A smooth and freshly cut profile should be taken for examination. The examination may be made on both sunny and shady side. Colour is the first thing which is noted to differentiate the different layers. Then the texture, structure, consistency and density etc., are noted for demarcating the different layers. The presence of concretion, spread of roots, effervescence with Acid etc., are also noted. All this information collected is recorded in profile index register wherein locality, relief, natural vegetation, drainage, degree of erosion etc., are also noted. A rough sketch of profile is also drawn therein.

During the survey of selected village, the technique of soil variation may be used for general mapping of the area. On completion of the detailed reconnaissance survey, soil map of the area on the basis of grid observation should be prepared. One profile per unit of soil could be examined and the profile samples should be collected layerwise. In case if any one horizon is more than 12" thickness, two samples should be collected by suitably dividing horizon. In no case the depth of profile sample should exceed 12" for each horizon. Photographs of the important soil profiles should be taken after clearly marking the different horizons.

CHAPTER V

COLLECTION OF SOIL SAMPLES

1. Grid Samples

Grid samples should be collected up to a depth of 12" or upto murum depth if murum is within 12". Samples may be drawn by means of screw Auger or posthole auger at three or four places in the vicinity of grid spot and a composite sample collected representing general soil conditions there. The soil sample thus collected should be thoroughly mixed and divided into four halves. The two halves opposite to each other may be thrown away and remaining two halves may again be mixed. In this way, a requisite sample of about 2 Kg., may be ultimately kept by repeating this process. The sample may then be filled in thick cloth bag and properly labelled. A sample label may also be kept in the sample bag (The pro forma of sample label may be referred). In this label, name of village, grid spot number, depth of samples, date of collection of soil sample etc., may be given. The sample slip should be written by using copying pencil. Similarly, on the sample bag name of village and grid sample number may be mentioned.

2. Profile Samples

In the case of profile samples horizon-wise samples are to be collected. If the horizon is thicker than 12", it may be suitably divided and two samples collected from the said horizon. Uniform sample should be collected by scraping equal soil within the required depth of horizon. As mentioned above, the collected sample may be thoroughly mixed and brought to requisite quantity. The samples should be filled in thick cloth bag and duly labelled. On the bag itself name of village, survey number and profile number and sample depth may be shown while the detailed information in the form of sample label may be left in the bag itself.

CHAPTER VI

COLLECTION OF MONOLITH

Monolith of typical soil profiles observed in the division may be collected. For this purpose, monolith boxes 4" wide, 2' deep and of requisite length upto murum layer or 5 feet so as to include the solum and a part of the "C" horizon are prepared. A projection of soil column in the profile may be drawn by scraping the soil on the side to a requisite depth, so as to closely fit in the box. The box is then placed on this column and the soil column is then cut off from the profile wall by means of a sharp Khurpa or scraper and knife. Then the soil is cut off to the exact level of the box and a glass pannel is fixed to it after spraying with a protective coating of venylacetate.



CHAPTER VII

COLLECTION OF MICRO-MONOLITH

Small thin sections proportionate in length of each horizon are taken out with scraper and fitted in a small tube or rectangular box. The soil sections are placed one above other as per scale. This gives appearance of a miniature monolith. Such monolith could be collected by the survey parties and kept at their headquarters for reference.

The following information should be mentioned on monolith label at the bottom of the monolith:

- (i) Name of the soil type or class.
 - (ii) Locality, village, survey number, taluka and district.
 - (iii) Thickness of horizons.
 - (iv) Date of collection of the monolith.
 - (v) Signature of soil surveyor responsible for collecting the monolith.
-

CHAPTER VIII

SOIL MAPS

All the survey information collected will have to be presented suitably in the form of soil maps showing the distribution of different kinds of soil and their characteristics.

Broad grouping of soils for suitability of irrigation, land capability, etc., are detailed as below:—

1. Irrigation Capability

The suitability of land for irrigation and irrigation cultivation is mainly influenced by its depth, permeability, surface slopes, texture, structure, water holding power, drainage and such other physico-chemical properties. The soils recommended for irrigation should necessarily have the following qualities for soil and water conservation under irrigation cultivation:

- (a) Soils must be permeable to leach out harmful salts.
- (b) Soils must have stable crumb structure and high moisture holding power. The water should also be readily available to plant. Highly calcium saturated soil fulfil such condition.
- (c) Soils should neither be very shallow nor very deep. It must have sufficient depth for development of root system of plant i. e., 18"-48".
- (d) The land should be gently sloping plain and should have easy drainage facilities. Minimum land development should be involved in bringing area under irrigation.
- (e) The soils should be productive i. e., rich in plant nutrient status and favourable in structure.

Based on the data collected in standard soil survey and the aforesaid directives, grouping for irrigation purposes may be shown as below:—

- I. Lands quite suitable for irrigation ... Green colour
- II. Land suitable for protective irrigation ... Yellow colour
- III. Lands unsuitable for irrigation ... Red colour

2. Land Capability Grouping

On the basis of the data collected under the standard soil surveys the following 8 land capability groupings as suggested under All India land use survey may be made: -

Group I

Land which is fairly level, deep, with a good tilth, productive, easily workable, well drained and not subjected to damaging floods come under this group. It is suited for intensive cropping without any major soil amendment.

Group II

Land gently sloping to gentle rolling plain, moderately susceptible to erosion, moderate depth, moderate drainage, come under this class. The defects, if any, are easily correctible. Good land and can be cultivated with some simple soil conservation practices, such as strip cropping, contour cultivation, suitable rotations with legumes, occasional green manuring.

Group III

Lands with moderately steep slope, susceptible for erosion, restricted drainage, depth varying, presenting problems of soil conservation, drainage, and poor fertility, fall under this group. These soils could be used for crops with adopting suitable soil conservation measures such as terracing, providing drainage, addition of bulky manures and adoption of suitable rotations.

Group IV

Fairly good land that could be best maintained to perennial vegetation, but could be cultivated occasionally to a limited extent. The cropping use is restricted because of natural features, such as slope, erosion, unfavourable soil conditions or adverse climate. It needs special cropping system and practices to protect against erosion and to conserve moisture.

Group V

Cultivation is not feasible because of one or more factors, such as shallowness, wetness, stoniness some other limitations, undulating lands presenting erosion hazards. Bottom lands sus-

ceptible for frequent submergence preventing normal cultivation of crop, fall under this group. Land is suited for grazing and forestry or may be recommended to keep under perennial vegetation.

Group VI

Land is steep, subject to erosion, very shallow, not suited for cultivation. However, by careful management could be brought under pasture or forestry.

Group VII

The lands under this group are subject to severe limitation because of very steep slope, shallow, rough and stony surface features. It can be used for grazing or forestry if carefully handled.

Group VIII

Lands unsuited for cultivation, grazing or forestry, because of unfavourable characteristics such as marshes, deserts, ravines, very steep slopping, stony and barren.

CHAPTER IX

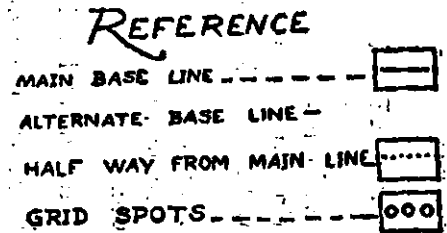
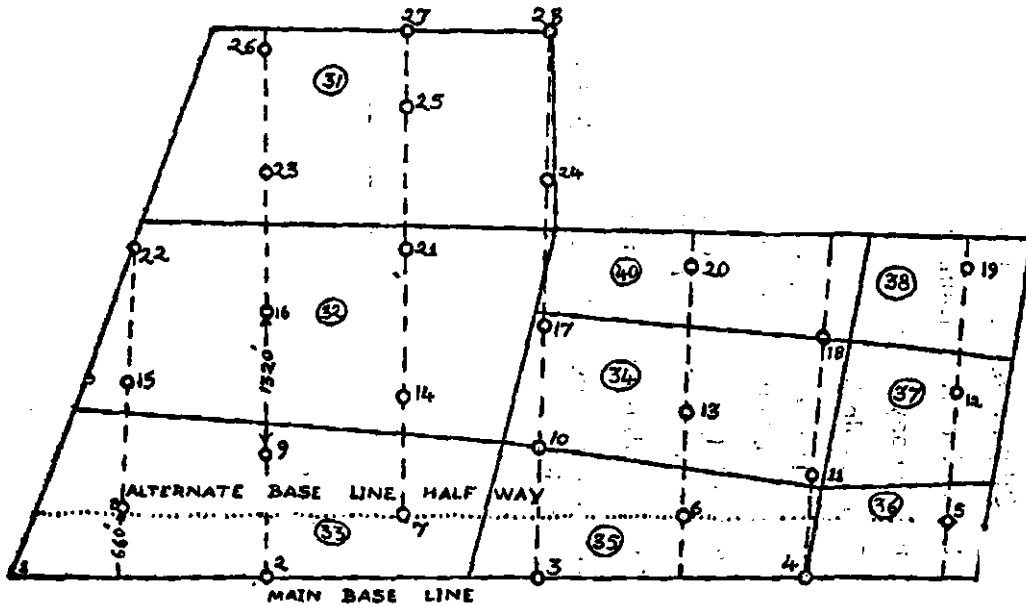
PREPARATION OF VILLAGE SOIL SURVEY REPORT

The village soil survey report should be thorough but at the same time it should be brief. The following points may be dealt with in order:—

1. Introductory—giving information about the location of village and object of survey in brief. Period of survey etc.
 2. Agricultural information of village.
 3. Normal yields of major crops grown in the village.
 4. Climate of the village.
 5. Native vegetation.
 6. Geology.
 7. Hydrology.
 8. Soils and soil classification. No. of grid samples collected and profiles examined.
 9. Soil types, their description problems and recommendations for development.
 10. Distribution of area under different kinds of soils.
 11. Development plan suggested for soil and water conservation.
-

CHAPTER X
**PROFORMAS TO BE ADOPTED IN CARRYING OUT
 THE SOIL SURVEY**

A SKETCH SHOWING LOCATION OF GRID SPOTS
 & PLAN OF STAGGERING



PRO FORMA—I

Name of village: Sub: Tal: Dist:

I. (A) *Total area of the village*

- (a) Total cultivable area ...
- (b) Total fallow (current) ...
- (c) Total pot kharab— ...
- (i) in cultivable area—
- (ii) miscellaneous pot kharab
 such as gaothan, river,
 roads, nalas, etc.
- (d) Total dry area ...
- (e) Total irrigated area ...
- (f) Total double crop area ...
- (g) Total area under Gairanq ...
- (h) Total forest area— ...
- (i) Reserved ...
- (ii) Revenue ...
- (iii) protected—
 Intensity of forest—thick/
 medium/spars.
- (i) Total assessment of village ...
- (j) Total population of village ...
- (k) Total population of cattle—
 with horns and without
 horns.
- (l) Total No. of working animals—
 for agricultural purposes,

(B) Climate:**Rainfall and its distribution—**

- (i) kharif rains ...
- (ii) Rabi rains ...
- (iii) period of torrential rains ...

(C) Sources of Irrigation:

- (i) Canal ...
- (ii) River lift ...
- (iii) Wells in catchment area—
 - (a) working wells ...
 - (b) non-working wells ...
 - (c) depth of water table in wells—
 - Rainy season ...
 - Winter Season ...
 - Summer season ...
 - (d) quantity of water—
 - Sweet ...
 - Salty ...
 - brackish ...
- (iv) Nature of irrigation—
 - (a) Perennial irrigation ...
 - (b) seasonal irrigation ...
 - (c) light (protective irrigation).

II. Important Crops and their distribution:

| Name of the crop | A R E A | | |
|-------------------------------------|---------|-------|-----------|
| | Kharif | Rabi | Irrigated |
| (a) Cereals | | | |
| (b) Pulses and Legumes | | | |
| (c) Fibre crops | | | |
| (d) Sugarcane and other cash crops. | | | |

III. Natural Flora of the Village:

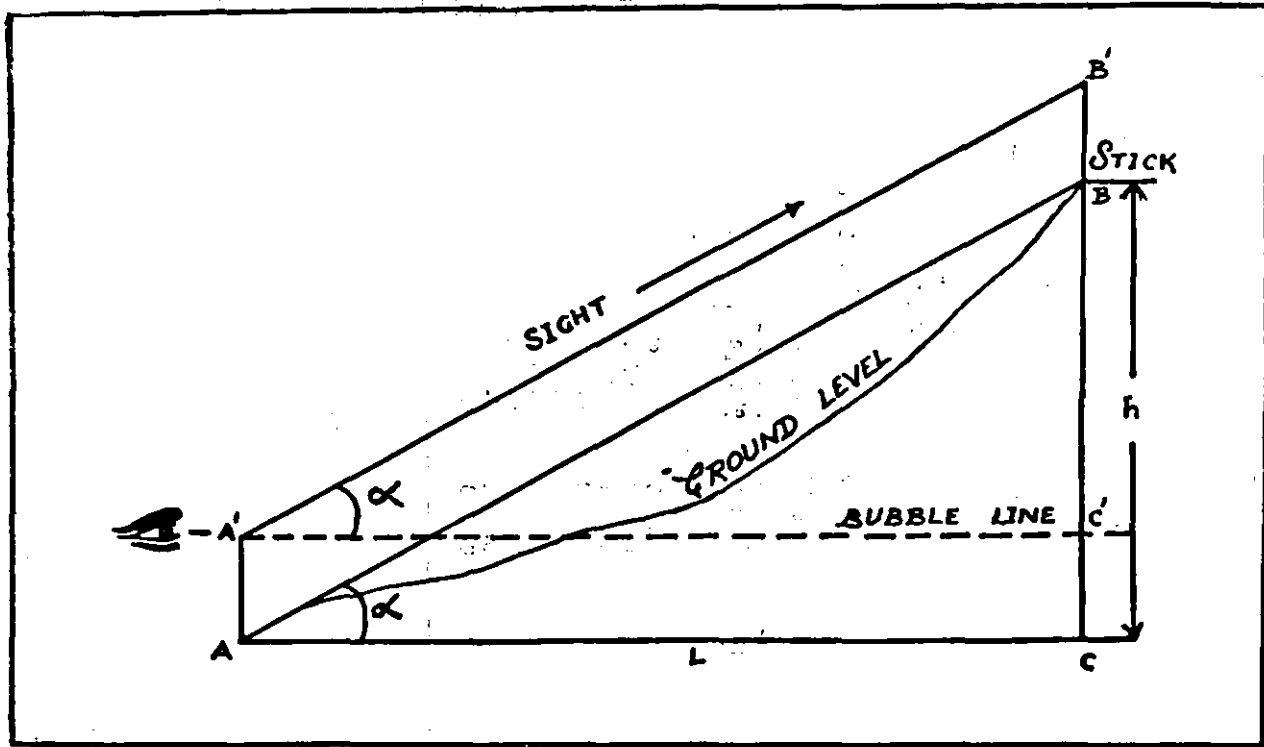
- (a) Main trees
- (b) Grasses
- (c) Others

IV. *Normal yields of the important crops of the village:*

V. *Major soil and land problems of the village:*

- (a) Development of saline, alkali, flood in undulating water logged soils.
- (b) Brackish water and other water problems.
- (c) Gullied and ravine lands and eroded lands.
- (d) Problems of weed infestation, wild animals and white ants and others.
- (e) Labour problems and cattle problems.
- (f) Communication.

Use of Abney level.



Have a stick of the height of the observer's eye and mark the top of the stick with a colour strip. If the gradient between point A and B is to be measured, take the angle of elevation or depression as shown in the figure above.

The angle B'A'C' which is the same as that of angle BAC, since the side A'B' is parallel to AB and A'C' is parallel to AC.

$$\text{Tangent of the angle} = \frac{\text{Height}}{\text{Length}} = \frac{h}{L}$$

if the distance of observation is kept as 100', then the following formula will give percentage slope:

$$100 \tan \alpha = \text{Slope } \%$$

Natural tangent table is given below:—

| Degrees | Natural Tangents | % slope | Degrees | Natural Tangents | % slope |
|---------|------------------|---------|---------|------------------|---------|
| 0.0 | 0.0000 | 0.0 % | 4.5 | 0.0797 | 7.87 % |
| 0.5 | 0.0089 | 0.87 " | 5.0 | 0.0875 | 8.75 " |
| 1.0 | 0.0175 | 1.75 " | 5.5 | 0.0963 | 9.63 " |
| 1.5 | 0.0262 | 2.62 " | 6.0 | 0.1051 | 10.51 " |
| 2.0 | 0.0349 | 3.49 " | 6.5 | 0.1139 | 11.39 " |
| 2.5 | 0.0438 | 4.38 " | 7.0 | 0.1228 | 12.28 " |
| 3.0 | 0.0524 | 5.24 " | 8.0 | 0.1405 | 14.05 " |
| 3.5 | 0.0612 | 6.12 " | 9.0 | 0.1584 | 15.84 " |
| 4.0 | 0.0699 | 6.99 " | 10.0 | 0.1853 | 18.53 " |

SAMPLE LABEL

Location

Village

Taluka

District

Survey No.

Grid No.

Depth of Sampling

Profile No.

Date of collection

Signature

PROFILE INDEX FORM

1. Location—
 - Village and Sy. No.
 - Taluka—
 - District—
2. Land scape or relief: Relatively level/
plain sloping/rolling/undulating roll-
ing/gullied to ravine/hilly/other
complexes.
3. Direction of slope—
4. Position of the profile on watershed—
on plateau/on ridge/ in depressions.
5. Erosion—none to slight/moderate/seve-
re, very severe.
6. Slope of land—0-1 per cent/1-3 per cent/
3-8 per cent/8-15 per cent/above 15
per cent.
7. Climate—Rainfall—Temperature
Maximum, Minimum.
8. Drainage—poor/moderate/good/exces-
sive.
9. Depth of soil -0-3", 3 to 9", 9-18", 18 to
36" and above 36"
10. Natural vegetation.
11. Soil—type and local name of soil—
12. Water table—(a) depth, (b) seasonal vari-
ation (c) nature of water-sweet/bra-
kish/salty.
13. Present land use.
14. Date.

| Profile No. | Colour | | Texture | Structure | Consistency and density | Miscellaneous observations roots, concretions, stenines, permeability, cracking etc. | Sample depth | pH | T. S. S. or conductivity mm. per cm. | CaO _g | Remarks |
|-------------|--------|-------|---------|-----------|-------------------------|--|--------------|----|--------------------------------------|------------------|---------|
| | Dry | Moist | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| | | | | | | | | | | | |

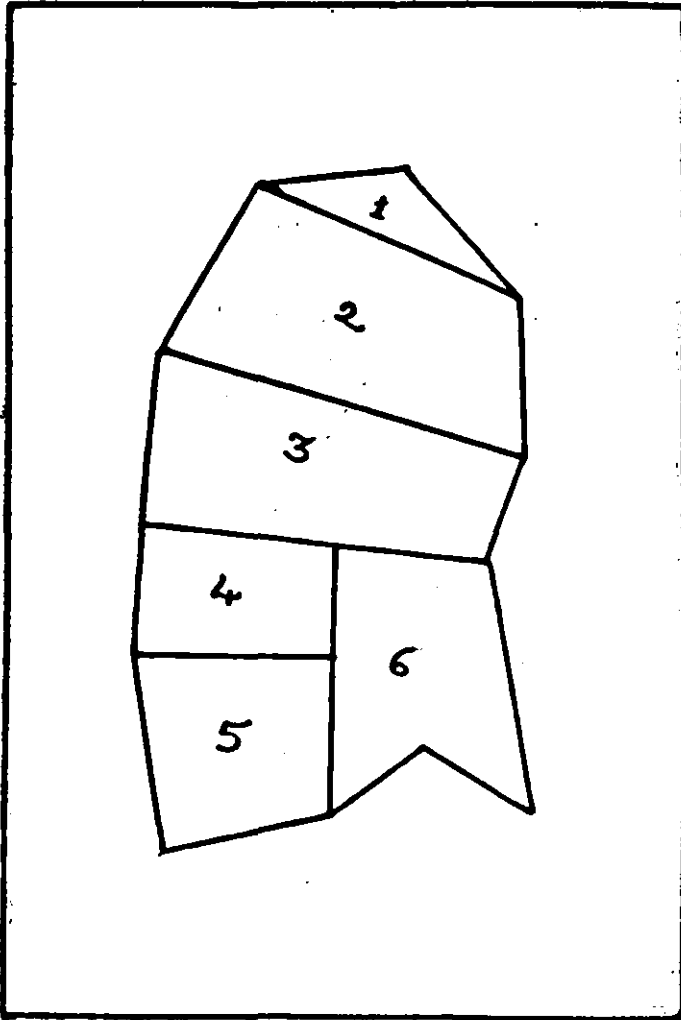
EXTRACT OF VILLAGE MAP

Block No.—

Village :

Taluka :

Dist. :



PROFORMA OF FIELD BOOK

| Sy. No. | Area | Local Name of the soil | Grid no. | Dept of soil | Present slope and land-scape | Colour of soil | Texture of soil | Structure of soil | Extent of erosion | Present land use | Major problems faced with | Remarks |
|---------|------|------------------------|----------|--------------|------------------------------|----------------|-----------------|-------------------|-------------------|------------------|---------------------------|---------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| | | | | | | | | | | | | |

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