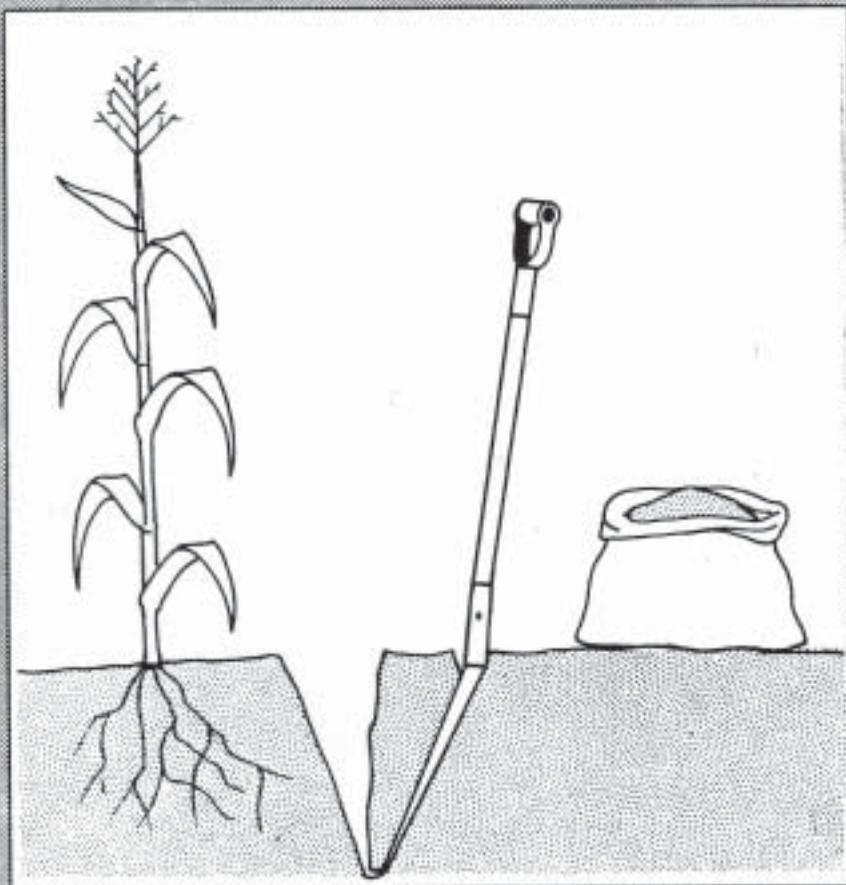


SOIL SAMPLING FOR CROP LANDS



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Revised and updated June 1990 by
Soils Laboratory, Department of Agricultural Research,
Private Bag 0033, Gaborone.

Soil Sampling for Crop Lands **(and virgin land intended for crops)**

A soil analysis service is available at the Agricultural Research Station at Sebele, Gaborone. The soils laboratory there is equipped to provide a comprehensive soil analysis service to agricultural staff and farmers. However, soil analysis is only as good as the sample it comes from. It is important that samples submitted to the laboratory are representative of the area they are taken from. The purpose of this leaflet is to give guidelines to those who will take samples for the assessment of fertility levels in a field.

Why Sample?

No two land areas are the same; they vary in soil type, past treatment and fertility levels. However, most lands have been chosen because crop plants will grow successfully on that soil provided there is sufficient rain. As the crops are grown on the land year after year, the nutrient level of the soil decreases. It is important to put the nutrients taken out by the crop back into the soil by using chemical fertilizers or manure. If chemical fertilizers are to be used, an analysis of the nutrient levels already in the soil is desirable so that economically optimal rates of fertilizer application can be given to the farmer. Once a field has been sampled properly and recommendations given, the field advisor should be consulted about when to sample again.

If you think a soil analysis would be helpful in your work then you should take advantage of the service that is offered. To reap the greatest benefit from your sampling, follow the instructions given in the next few paragraphs carefully.

Sampling Procedure

Timing

Samples are best taken in winter when the soil is dry and a kind of equilibrium exists. Recommendations can then be given for the next cropping season.

Sampling Area

First obtain a clear idea of the area to be sampled. It should not be too big, otherwise the analysis results from a single sample will be misleading. Areas larger than three hectares should be divided into smaller areas for sampling purposes.

The area chosen for sampling should be uniform with respect to soil colour, vegetation and cultivation treatment. If one area is distinctly different from another, it should be excluded or sampled separately. This is particularly important when parts of the field may have had different treatments i.e one part may have been kraal manured, another received fertilizer or another been cultivated for a longer period of time. These areas should be sampled separately. The 'lands history' is essential in determining uniform areas and close questioning of the farmer is often required.

If plant growth is good on one part of the field and bad on another, samples should be taken from the two areas and kept separate. In the diagram below (fig. 1), the letters represent different sampling areas.

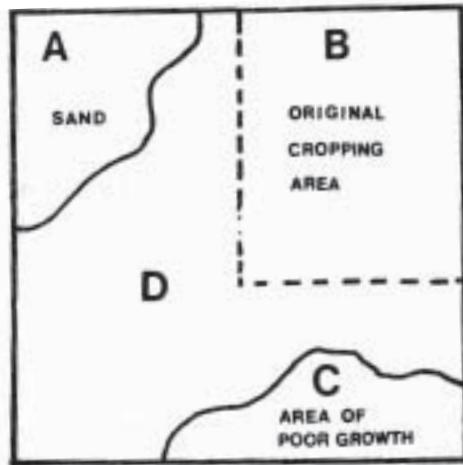


Figure 1

Sample Information

Before sampling, fill in as much of the information sheet (given at the back of this booklet) as possible. Complete it after sampling and make sure it is attached to the sample. Routine analysis consists of measurements of pH, organic carbon, phosphorus, calcium, magnesium, potassium, sodium and cation exchange capacity.

Further copies of the information sheet can be obtained from the soil laboratory (address on page 9) or the example given on the next page can be photocopied.

Tools required

Before sampling, ensure that a clean sample bag of paper or plastic is available. (Bags that have been used previously for soil, fertilizer or other chemicals must not be used). Label this bag clearly with the area the samples are taken from and write this on the information sheet too.

Usual sampling tools are a spade or an auger (fig. 2). Make sure your tool is clean. A plastic container is useful for collecting the sub-samples.

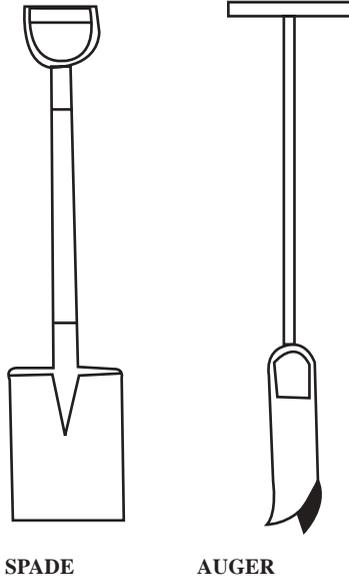


Figure 2

Selection of Sampling Points

The most convenient method of obtaining a representative sample of a given area is to take a number of subsamples from different spots in the field then mix them together. To select the sampling points, which should number at least 20, a set pattern should be used as follows: Imagine a series of parallel lines drawn across the area to be sampled (fig. 3)

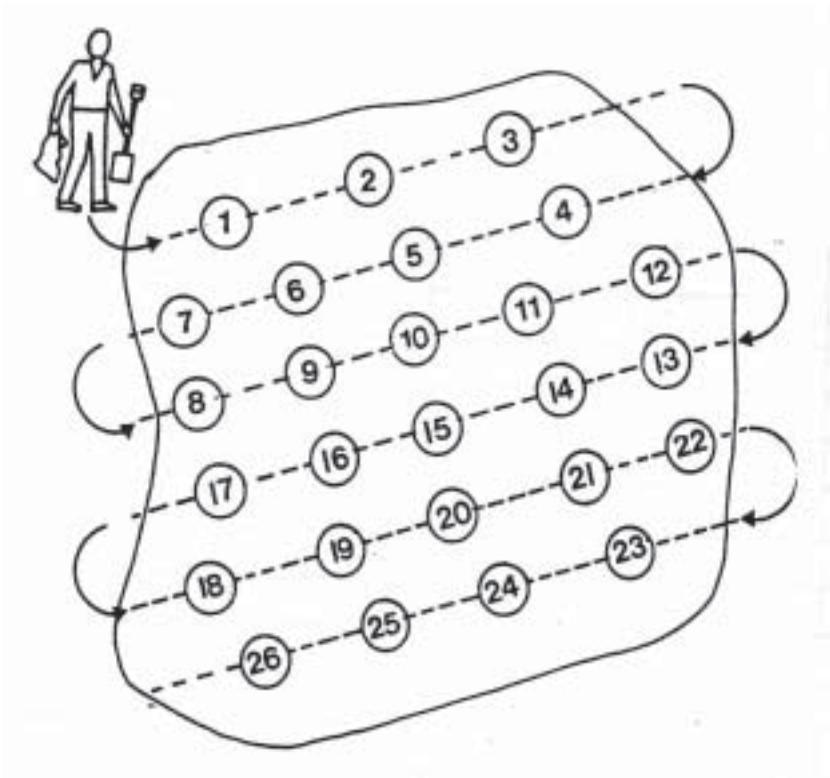


Figure 3

The sampling should begin on the first of these lines (line A) on one side of the field. Walk down the line for 5 to 10 paces to reach point 1, from which the soil is removed to make the first subsample. The sampler should then pace another 10 to 20 paces along the line to reach the next spot for sampling (point 2). He continues along the parallel line until the edge of the field (or selected sampling area) is reached then he moves to the next imaginary parallel line some 10 to 20 paces away (line B). Sampling is then continued along this line in the same way as for A. The process is continued until subsamples have been removed from the whole sampling area. Remember that areas larger than 3 ha should be subdivided.

Care must be taken not to remove soil near the edge of the field (i.e not nearer than 5 paces) nor too close to minor irregularities such as ant workings, rocks or paths. The number of paces taken between sampling points will vary according to the size of the area to be sampled but must be regulated so that the final sample consists of at least 20 subsamples.

Removal of Soil for Each Subsample

The recommended depth of sampling is 20cm, however on many lands, it is adequate to take samples from that depth of soil that the plough works (15cm). Remember that the depth of sampling must be stated on the information sheet. There are two recommended methods for taking a subsample.

a) auger: a 7cm post hole auger (fig. 2) is the easiest tool to use in many cases. It is simply twisted into the ground and then lifted, with the soil remaining in the auger. The soil is then removed and put into a container. Usually the sampler will have to make at least two borings for each subsample to reach the required depth. A mark on the handle at 20cm will show when the right depth is reached.

b) spade: dig a V-shaped hole into the ground 2cm below the sampling depth (fig. 4)

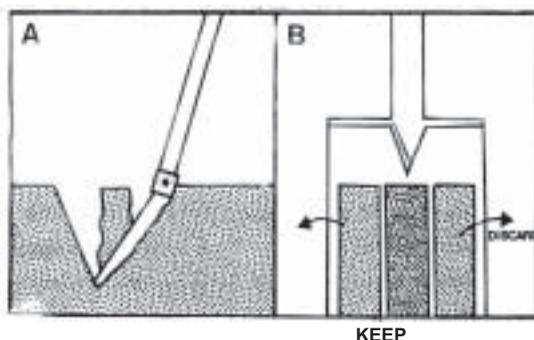


Figure 4

Use the spade to take a thin slice 1cm to 2cm thick off one face of the hole. Divide this slice into 3 equal sections vertically and discard the 2 outer sections while keeping the middle portion as the subsample for that point.

Reducing the Size of the Sample

When all the subsamples are collected, it is often found that the total sample is too big. In this case, thoroughly mix the sample, breaking up all the lumps by hand. Finally, on a piece of paper or board, form the soil into a cone (fig. 5).

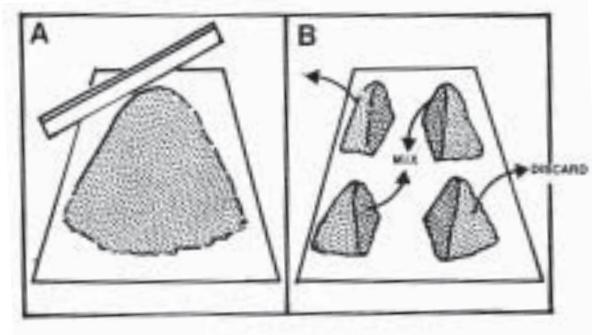


Figure 5

Divide this heap into quarters by using the spade or other suitable implement. Discard two opposite quarters, mix the remaining two and repeat the process until 1kg of soil remains.

Sample Dispatch

The sample should then be placed in the labelled bag and dispatched with the information sheet, as quickly as possible to the soils laboratory.

Any enquiries should also be directed there.

Address: Soils Laboratory,
Department of Agricultural Research,
Private Bag 0033,
Gaborone

Tel: 3668143/6 Fax: 3928965

Interpretation of Results

When the analysis comes back with recommendations for nutrient applications, the farmer needs to know how much fertilizer to add to his field. The following tables can be used to calculate this. Firstly the amount of nutrients present in each 50kg bag of fertilizer needs to be known.

Fertilizer	Nitrogen(N)		Phosphorus(P)		Potassium(K)	
	kg	lb	kg	lb	kg	lb
Single super (10.5% P)	0	0	5.3	11.7	0	0
2,3,2 (22)	3.2	7.1	4.7	10.4	3.2	7.1
3,2,1 (25)	6.3	13.9	4.1	9.0	2.1	4.6
4,2,1(31.5)	9.0	19.8	4.5	9.9	2.3	5.1
4,1,1 (33)	11.0	24.3	2.8	6.2	2.8	6.2
LAN (28)	14.0	30.9	0	0	0	0
Urea (46)	23.0	50.7	0	0	0	0

Hence, if a farmer added 1 bag per Ha, he would be adding the amount of nutrients given in the table above to that area. eg applying 1 bag 2,3,2 to a Ha, he would be applying 3.2 kg/ha N, 4.7 kg/ha P and 3.2 kg/ha K (or if he added 1 bag per acre, 7.1 lb/acre N, 10.4 lb/acre P and 7.1 lb/acre K).

So if he was recommended to add 20 kg/Ha P, on the basis of the & soil analysis, he could apply to each ha of his field:-

a) single super: $20/5.3 \text{ kg/Ha} = 3.8$ bags per Ha, where 20 is the recommended rate in kg/ha and 5.3 is the amount in kg of P in a bag of single super (see table). The number of bags per ha could be rounded to 4 if it makes application easier.

Alternatively, he could apply:-

b) 2,3,2: $20/4.7 \text{ kg/Ha} = 4.25$ (41/4) bags per Ha.
where 4.7 kg is the amount of P in 1 bag 2,3,2 (see table).

If the farmer knows the area of his field in acres not hectares, first convert the recommendation to kg/acre by dividing by 2.47 as 1 Ha = 2.47 acres. eg. $20 \text{ kg/Ha} = 20/2.47 = 8.1 \text{ kg/acre}$ then use the same procedure as above:-

a) single super: $8.1/5.3 = 1.5$ ($1\frac{1}{2}$) bags per acre.

or

b) 2,3,2: $8.1/5.3 = 1.7$ bags per acre. This could be rounded to 2, to make application easier.

If another fertilizer is used rather than the ones given in the examples above, the same procedure is used to work out the application rate:-
i.e recommendation (kg/ha)/amount nutrient in bag (kg) = bags per ha to apply.

Compound fertilizers (2,3,2; 3,2,1) also apply N and K as well as the P that was recommended. Unless the recommendation includes these nutrients, it is better to apply single superphosphate as using compound

fertilizers always works out more expensive per kg nutrient applied if only one nutrient is needed.

Summary

- 1) Soil analysis is only as good as the sample.
- 2) Samples must be taken from a uniform area.
- 3) Areas larger than 3 ha should be subdivided.
- 4) The comprehensive information sheet must be completed.
- 5) The samples must be taken correctly and on a regular pattern.
- 6) The final sample must consist of at least 20 subsamples.
- 7) The final sample should weigh about 1kg.
- 8) The samples should be dispatched as quickly as possible with the information sheet attached.

Glossary

The Size of a Field.

1 hectare (ha) = 1000m²
= 2.47 acres
= 100*100 long paces

1 acre = 4840 square yards
= 0.4 ha
= 100*50 paces

Weights

1 kilogramme (kg) = 1000g
= 2.205 lb

1 metric ton = 1000 kg
1 pound (lb) = 16oz
= 0.454 kg

1 bag of fertilizer weighs 50 kg.

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