Technical Paper 6

LABORATORY METHODS AND DATA EXCHANGE PROGRAM FOR SOIL CHARACTERIZATION

A REPORT ON THE PILOT ROUND

PART I: CEC and TEXTURE

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ABSTRACT

To gauge the need for possible standardization of analytical procedures used for soil characterization and classification, twenty laboratories from all over the world analyzed ten "reference" samples on particle size distribution and cation exchange capacity. The analytical results in general show a large variability both in accuracy and precision which are dependent on type of soil and laboratory. This strongly points to the need for standardization of analytical procedures. The results also indicate that such standardization is feasible but that a certain, not insignificant level of variability will remain unavoidable. Such estimated levels are (relative figures): ± 20% for CEC, ± 11% for clay determination and ± 25% for CEC of the clay. Consequently, classification criteria based on laboratory analyses should be used flexibly.

1. INTRODUCTION

Complying with the recommendations of the 2nd International Soil Classification Workshop held in Malaysia and Thailand in 1978, sponsored by U.S.A.I.D., the International Soil Museum[1] at Wageningen initiated a program[2] for cross-checking, correlating and possibly standardizing laboratory methods used for soil characterization in various parts of the world.

It was decided to start the program with a pilot round in which a limited number of laboratories would analyze a selection of divergent soils on some essential parameters. The results obtained in this round as well as future funding possibilities would be decisive for a possible continuation of the program in extending the number of participants, soil parameters to be analyzed and soil types.

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[1] As from 1984 named International Soil Reference and Information Centre (ISRIC)
[2] In cooperation with the Royal Tropical Institute, Amsterdam

All 22 invited laboratories, about half from "developed" and half from "developing" countries (see Appendix 2), accepted to participate and were supplied with 200 grams of 10 "reference" bulk samples prepared by ISM[1] (see Table 1, p. A-1). They analyzed these samples on two parameters notoriously suspected to be dependent on the methods used, viz. particle size distribution and cation exchange capacity according to their usual procedures.

2. MATERIALS AND METHODS

2.1 Soils

The soil samples selected as "reference" samples host a number of aspects relevant in soil characterization. Samples 1 and 2 (Oxic Paleudult/ferric Acrisol) contain the argillic horizon aspect at relatively low clay content, whereas samples 6 and 7 (Orthoxic Palehumult/humic Nitosol) have this at much higher clay content. Samples 3 and 4 (Typic Eutrustox/rhodic Ferralsol) represent possible problems associated with oxisols such as CEC boundaries and dispersion difficulties. Samples 5 (Typic Natrargid/orthic Solonetz) and 10 (Typic Fluvaquent/calcaric Fluvisol) were included to represent solonetzic and calcaric soils respectively. Finally, an Andept was selected in connection with both charge behaviour and dispersion problems (samples 8 and 9). Bulk samples of about 75 kg of each "soil" were air-dried at about 20°C, mortar-crushed and passed through a 2 mm sieve. Each sample was then very thoroughly mixed in a 200 litre container and transferred to 10 litre buckets for storage and dispensing.

2.2 Data processing

The methods used by the participating laboratories are given in Appendix 1. Only a few laboratories gave duplicate results of their analyses. In these cases we averaged them for the present purpose.

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[1]with the kind cooperation of the Kenya Soil Survey

Several laboratories gave particle size distribution data rounded off to whole figures. For uniformity we rounded off the data that were given with decimals except the silt values of samples 3 and 4 which appeared to be very low: rounding off would lead to relatively high deviations from the original values.

Unfortunately, the treatment of data was somewhat complicated by the fact that no agreement exists on the clay/silt boundary. Some laboratories call silt the fraction 2-50 µm (and consequently sand 50-2000 µm) whereas others take silt to be the fraction 2-20 µm (and sand 20-2000 µm), the majority determined both fractions, however. To do justice to the efforts of all laboratories and because of the wealth of data, it was decided to include both sets of data in the statistical treatment.

In addition to the direct results of CEC and particle size distribution analysis some derived parameters were calculated for practical purposes. Firstly, the CEC of the clay, being a much used parameter in soil characterization and incorporating possible errors made in the CEC as well as in the clay determination. Secondly, the silt/clay ratio to underscore a major source of error in particle size analysis: the dispersion procedure. Aggregates of clay particles surviving pretreatment may largely be assigned to the silt fraction (and to the sand fraction, but this is not looked into here).

Statistical treatment of the data was perfomed using computer programs from the SPSS (Nie et al., 1975).

3. RESULTS AND DISCUSSION

In the present study we are dealing with two variables of which the significance has to be tested for each soil parameter:

1. Soils (soil sample difference)
2. Laboratories (different methods of analysis)

The print-out (see Tables 3 to 6) of the used program for analysis of variance (SPSS, "ONE WAY") includes sums of squares, degrees of freedom, mean squares and tables of the means of the tested variable, the standard deviation

of these means (a measure of the variability or "noise" of the set of data from which the mean was calculated), the standard error (= standard deviation divided by the square root of the number of counts), minimum and maximum values of the set of data and the 95% confidence interval for the mean, which are the bounds of uncertainty about the mean caused by the variability of the data (= mean ± ca. 2x stand. error). The significance of the test is expressed by the F-ratio (the higher the F-ratio, the greater the significance).

The data are presented in Table 2, left-hand side. For technical reasons, two laboratories were not able to send in their results in time for the present round so that the matrix consists of 20 laboratories having analyzed 10 "soils".

3.1 Soils

Table 3 gives the analyses of variance of the data per soil. For all parameters the soils appear to be very significantly different (1% level), a goal that was aimed at by the selection of the samples. The columns "mean" give the average values of the parameters as they were determined by all laboratories. These values, which are also presented in data Table 2 (horizontal columns "mean") will be used as reference values in this study.

> It could be argued that this choice is not quite justified since for the calculation of the means extreme values ("mavericks") have not been excluded. In statistics it is custom to reject any value in a set of data that exceeds the value of mean ± 2x standard deviation. It is doubtful whether there exists a "true" value of any of the soil parameters under discussion here since they are sensitive to the procedures used for their determination. Moreover, the aim of the present study is not to determine a "true" or "best" value for the parameters but rather to collect information on the variability of data both for general information as well as for the individual participant on his performance.

The standard deviation gives an indication of the variation of the data, in other words, how "difficult" a soil is in a particular parameter. The standard deviation values of Table 3 cannot be compared directly since their

magnitude depends on the magnitude of the mean of each soil which was significantly different in all cases. One way to overcome this is to compare the relative standard deviation values, i.e. the standard deviation divided by the corresponding mean of the parameter. Another way, giving more information, is to perform the analysis of variance on the *deviations from the mean* whereby the magnitude of the means is eliminated. This gives both a directly comparable characterization of the soils as well as a useful set of data for easy comparison of performances of laboratories.

A choice can be made between using absolute or relative deviations. To decide on this, a regression analysis was performed on the absolute deviations from the mean using the SPSS program "SCATTERGRAM". Figure 1 (p. A-34) shows the print-out for each soil parameter (excluding silt/clay ratio), the resulting regression line was drawn by hand using the calculated intercept and slope.

The Pearson's r^2 values are poor for all parameters. However, except for the sand content, there appears to be a positive correlation of the deviations with the magnitude of the means. The negative correlation with the sand content is not surprising: clay, silt and sand contents are complementary parameters. Because of the nature of the materials and the way of measurement, high clay and silt contents are more prone to errors (aggregation, dispersion, pipetting, hydrometer) than high sand contents are (whole fraction is weighed). Thus, the higher the sand content, the smaller the error can be.

Because of the positive correlation found for the more important soil parameters the decision was made to work with proportional (%) deviations rather than with absolute values. In addition, such data expressed in percentage provide a universal, easy to compare set of dimensionless figures. They are also presented in Table 2 (right-hand side).

The analysis of variance of these deviations from the mean per soil is given in Table 4. As was stated earlier, this analysis is only meant to give information on the performance of all labs together on each soil. (Obviously, this is not a test for significance since the mean of the deviations per soil is nil by definition.)

The relative degree of difficulty of the soils is expressed by the relative magnitude of the standard deviations (or the proportionally related

standard error): the lower the values, the smaller the deviations from the mean. It appears that none of the soils is the easiest or most difficult in all parameters. Thus, soil 5 (Solonetz) appears to be the easiest in both the CEC and clay determination and hence in the CEC of the clay, but not in silt and sand. Soil 10 (Fluvisol) is the most difficult soil to determine the CEC of (calcareous!) while soils 8 and 9 (Andosol) are most difficult in the clay determination. The drying of this soil is probably responsible for a dispersion problem.

Calculation of the CEC of the clay often allows a rough check on the clay and CEC data (when the clay mineralogy is known). The most usual prominent error is probably the too low estimate of the clay content leading to suspectly high values for the CEC of the clay. Also, the presence of organic matter leads to an overestimate of the CEC-clay. On the other hand, appreciable errors may not be conspicuous either because data seem to be within reasonable bounds or because they cancel out to a certain extent e.g. a too low clay estimate is compensated by a too low CEC determination.

The present results show clear examples of all these features. The CEC of the clay of the Andosol (soils 8 and 9) in Table 2.1 is in many cases impossibly high even if the whole clay fraction would consist of allophane; at the same time the lowest CEC value found for soil 9 (lab 2: 9.5 me/100 g) coincides with a relatively low clay content (lab 2: 10%) yielding a CEC-clay of 95 me/100 g, a reasonable value for this type of soil.

Also, in soil 10 (calcareous Fluvisol) some impossibly high values of the CEC-clay occur, corroborating the malicious effect of carbonate on the clay determination (lab 13: -58% deviation from the mean) or on the CEC determination (lab 9: + 153% deviation) or on both (lab 10, CEC: +12%, clay: -12%).

Yet, also in the many cases where errors are not conspicuous, wide variations in results within soils do occur. This is further illustrated by the silt contents and the silt/clay ratios (Table 2.2, 2.3 and 4.4) where particularly the latter shows dispersion problems of the Andosol and Nitosol and also of the Ferralsol (although here the relatively low silt contents give a somewhat exaggerated picture).

The behaviour of the sand data has been discussed earlier. The agreement between the labs in striking (Table 2.3 and 4.5) for soils with high sand content (Acrisol, Ferralsol, Solonetz) but not so good for the clayey

Nitosol. The Andosol is relatively "noisy" while the calcareous Fluvisol takes in an intermediate position.

The standard deviations of silt 1 and silt 2 (Table 4.3) as well as of sand 1 and sand 2 appear not to differ appreciably.

The variability in textural classification of the 10 soils is shown in textural triangles in Figure 2 (p. A-38).

Some information on the variability in data is found in the column "95% confidence interval for mean" (Table 4). This column gives the limits within which the mean is situated with 95% confidence when the parameters are determined by 20 labs. This variability is in many cases disturbingly high. When the CEC is determined by 20 labs, the confidence interval is for 9 out of 10 soils (soil 5 is the "easy" soil) no better than $\pm$ 10% relative and for the calcareous Fluvisol as high as $\pm$ 21.6%! (Table 4.1). For the clay determination these figures look somewhat better except for the Andosol. The variability of the CEC-clay determination is no better than $\pm$ 14% (soil 5 excepted). Fortunately, this lowest figure is found for an oxic horizon (soil 4) where CEC-clay is a taxonomic criterion. Also for silt the variability varies widely per soil from as low as $\pm$ 4.7% for soil 1 to $\pm$ 63% for soil 4 (Table 4.3, silt 2).

Of more practical importance than the variability obtained by 20 laboratories together is the variability obtained by individual laboratories. This is discussed next.

3.2 Laboratories

An examination of the performance of individual laboratories has the important practical aspect that classification of a soil is nearly always based upon data of a single laboratory.

As expected, due to the very significant differences between soils, the analysis of variance of all data versus laboratories did not produce statistically significant differences between labs for any parameter. Therefore, as was done above, soil differences were eliminated by using the % deviations from the mean values of each soil. Table 5 gives the results of the analysis of variance of these deviations (see Table 2) per laboratory. In this way information is obtained on the relative performance of each laboratory on all

soils. The column "mean" is the weighted mean of the % deviations per soil and gives the overall performance of each lab relative to the others (these figures are also presented in Table 2: vertical column "mean" on right-hand side).

Since the Andosol (soils 8 and 9) appeared to behave suspect in some ways, the analysis of variance was also executed without the data for the Andosol (bottom print-out, Table 5).

It appears that the difference between laboratories is very significant (1% level) for all parameters. The influence of the "noisy" Andosol is not uniform: omitting this soil particularly increases the lab differences for the clay and CEC-clay determination but in other cases makes only little difference or even decreases the differences (CEC, sand).

To judge the performance of the individual laboratories two criteria have to be used: 1) the deviation of the lab mean from the "true" value (presently: the overall mean) should be as small as possible (good *accuracy*) and 2) the standard deviation or standard error of the lab should be as small as possible (internally regular data: good *precision*).

The use of the overall mean of the parameters as reference value in this study may somewhat comfort the laboratories with high deviations from this mean (low accuracy): improvements may be expected when standardization is accepted by all. As for the internal regularity of data (precision) it is uncertain if standardization will give similar improvement since this aspect is probably to a large extent a quality aspect of the individual laboratory.

In Table 5, for direct comparison, the "95% confidence interval for the mean" giving the variability range of each lab about its mean, has been converted to "half-width values" of this range which are presented directly after the mean values so that the performance of each lab is represented by the mean $\pm$ the error range of 95% confidence i.e. accuracy and precision side-by-side together constituting the *total variability* of each laboratory.

According to the present results[1], the most "accurate" CEC values (Table 5.1) are produced by lab 4, 5, 11, 16 and 19 (near to the mean), while relatively good precision is shown by labs 1, 5, 10, 11 and several others.

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[1]After processing of the data it was discovered that lab 10 has produced its data on air-dry weight basis rather than on oven-dry basis. This has some implications for the clayey soils, the data of which have been underestimated. For good order, the respective moisture pecentages as found by lab 10 for soils 1 to 10 are: 0.9 - 1.5 - 0.6 - 1.0 - 3.8 - 6.0 - 8.4 - 10.3 - 16.0 - 1.6.

Most accurate clay data (Table 5.2) are produced by labs 2, 6, 8, 11 and 20 on all soils and without the Andosol also by labs 9, 14, 16, 17, 18 and 19. The highest precision is obtained by labs 7, 10 and 16 on all soils and by a large number of labs when the Andosol is omitted[1].

The CEC of the clay data show a much larger variability both in accuracy and precision (Table 5.3). Accurate data are produced by labs 8, 11, 14, 19 and 20 on all soils and by some eight labs when the Andosol is omitted. The only precision below 10% error is achieved by lab 7 on all soils whereas several labs show improved precision without the Andosol.

A few labs show reasonably good accuracy in the silt determination (Table 5.4) but generally the accuracy is low as is the precision. By contrast, but as expected from the foregoing, the accuracy of the sand determination is good for several laboratories (2, 6, 8, 11, 13, 16, 18, 19) on all soils while the results are better still without Andosol. However, some other laboratories show remarkably low accuracy (1, 5, 9, 12, 15). The precision is generally disappointing (Table 5.8 and 5.9).

Thus, the data show that on the one hand there is reasonable to good agreement between several labs both in accuracy and precision (although these two do not necessarily coincide) but on the other they reveal a disturbingly large variability in the mean values of laboratories as well as high internal inconsistencies.

3.3 Classification aspects

Table 2 allows some observations on classification aspects of the variability of the data. The soil with a CEC-clay requirement at the highest level of classification is the Ferralsol/Eutrustox. In all cases the oxic horizon (Table 2.1, CEC of the clay, soil 4) appears to have a CEC-clay <16 me/100 g so that this soil seems to be a "safe" oxisol in this respect.

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[1] Lab 12 obtained exceptionally high clay contents (and thus low silt) for the Ando samples 8 and 9 due to a non-routine effort to recover "all" clay (repeated agitation and decantation for several weeks). Although this was contrary to instruction it casts an interesting light on the "true" value.

The Acrisol/Paleudult and the Nitosol/Palehumult have both been designated "oxic" at subgroup level with the requirement that the CEC-clay <24 me/100 g (by the NH_4OAc method). If the present B horizon is taken to have ferralic/oxic properties, then the Paleudult would not be designated as such by no fewer than 10 laboratories (Table 2.1, CEC of the clay, soil 2) and the Palehumult by 6 laboratories (same Table, soil 7). Obviously, the original designation "oxic" was subjective in itself and may well be wrong, the discussion only focusses attention to the consequence of the variability in the data.

The Acrisol (soil 1 and 2) and the Nitosol (soil 6 and 7) are both Ultisols with the requirement for an argillic horizon. In case of the Acrisol, only one laboratory does not differentiate between the clay contents of the A and the B horizon to this end (Table 2.1, clay content, lab. 1). In case of the Nitosol, only two laboratories (14 and 15) do not measure a sufficient clay increase (in fact, all three labs measure a lower clay content in the B horizon). However, several laboratories (2, 5, 7, 12, 18, 20) measured only 9% difference in clay content, just over the required minimum of 8%. Another 4 labs measured an increase of 10% or 11%. Considering the probability of an appreciable error in the clay determination (over 10% relative, see Table 5.2 and next section) in this case there can be quite some uncertainty on the reliability of data and chance plays a big role. Alternatively, this implies that by request of the person who classified the soil in the field, repeated analysis could well produce different data legitimately better suiting his classification.

3.4 Standardization aspects and prospects

From the large variability in data emerging in Table 5, the important question arises as to what in practice, after standardization, may be expected from soil analysis with respect to soil criteria. For a maximum result of standardization and optimization we shall have to discover the sources of error or deviation. Standardization of methods may greatly reduce the method bias, while interlaboratory cross-checking may reduce both method bias and laboratory bias. The sampling error, in the field and in the lab, which has an uncertain magnitude may be hard to reduce.

Looking at Table 5.1, for CEC the variability in accuracy (column "mean") may be reduced to $\pm$ 10% or somewhat better and in precision (column "95% conf. int.") to about the same so that maximum variability is still no better than

±18 to ±20%. An interlaboratory exchange program in the USA of seven labs, probably all using the same methods (USDA-SCS), on ten soils yielded similar results: 9.0% error in accuracy and 8.8% error in precision (Cronce, 1980). For the clay determination (Table 5.2) these figures can probably be better e.g. ± 5% accuracy and ± 6% precision totalling to ± 11% variability. In the USA program these figures are ± 4.5% accuracy and ± 9.1% precision respectively.

The CEC-clay determination shows a more gloomy prospect (Table 5.3). Although in individual cases under favourable conditions an overall variability of ± 15% or somewhat better could be realized, on basis of the present results it is more realistic to estimate that standardization will result in a variability of ± 10% ± 15% (accuracy and precision) totalling to ± 25%! This would imply that the 16 me/100 g CEC-clay limit for the oxic horizon should have a "flexibility" of 12-20 me/100 g and the 24 me/100 g limit of 18-30 me/100 g.

At least half of the laboratories employ the NH_4OAc pH 7 method to determine the CEC (see next section). Therefore, this method could be a serious candidate to be proposed as a "standard" method (no proposal is done at this stage). The relatively large number of data produced with this method allow an insight in the variability of results obtained with one method. The following table is directly taken from Table 5.1 and gives the relative performances of the labs using the NH_4OAc method on all soils.

Lab.	% dev.	95% conf.	Lab.	% dev.	95% conf.
1	-14.3	± 8.6	13	29.4	±12.3
5	2.0	± 8.8	14	21.5	±13.4
6	- 7.9	± 9.5	17	4.5	± 9.3
8	-12.2	±12.2	18	24.6	±22.5
11	1.0	± 7.0	19	0.5	±10.1

These figures show a considerable variability and analysis of variance gave an F-ratio of 8.9 meaning that the results are very significantly different at 1% level. This illustrates that standardization should in any case be done into detail.

3.5 Analytical procedures

As was expected, a variety of methods was employed by the laboratories to determine the CEC and the particle size distribution (see Appendix 1). Also when the "same" method was used, details often varied e.g. shaking time, leaching time. This strongly hampers the possibility of statistical treatment of data for significance of procedures. Since the collection of data do not result from an experiment with proper factor design, possible interactions of treatments are hard or impossible to analyze. Yet, an attempt was made to single out some of the most important method differences. The analyses of variance to test these factors are presented in Table 6.

CEC

Six different CEC methods or groups of methods were compared (see Table 6.1). Analysis of variance of the direct mean values indicated no significant differences between the methods (upper print-out) due to the large differences between soils (cf. Section 3.2, p. 7). However, after elimination of soil influence by using % deviations from the mean values of each soil the methods appeared to be very significantly different (bottom print-out). In the column "mean" can be seen that the compulsive exchange method yields much lower CEC values than the other methods (44% below the mean) while the effective CEC method (ECEC) also yields relatively low values (-14%). The $CaCl_2$ pH 7 method yields the highest values (+10%). It is no surprise that the NH_4OAc pH 7 method yields results near to the mean since the majority of data was produced with this method.

In Table 6.2 both the ECEC and compulsive exchange methods were individually tested against the other methods and both proved to give very significantly lower results than the other methods. It should be noted that of these methods the data of only one laboratory each was available[1].

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[1]The NaOAc pH 8.2 method was employed by one lab (3) on all soils and by another (12) on three soils. Since the results deviated only slightly from the mean (-7%, a positive deviation was expected) this method was taken up in the group "other methods"

CLAY CONTENT

In the particle size analysis several important pretreatments were applied by part of the laboratories and omitted by other.

The *H_2O_2 treatment* is omitted by about one fourth of the laboratories. Analysis of variance (Table 6.3) shows no significant effect of this treatment. In fact, omitting it seems to have a positive effect. This casts doubt on the results and strongly suggests interaction with other effects.

Also one fourth of the laboratories employ the *decantation method* to separate silt and clay from sand rather than *use a sieve*. With this method less clay seemed to be found but the difference is statistically not significant (Table 6.3).

Pretreatment *to remove carbonate* is routinely applied on all soils (also when carbonate is absent) by about one third of the laboratories. Two different reagents are used viz. the NaOAc pH 5 buffer and the HCl pH 3 solution. Table 6.4 shows that all practices yield significantly different results. The mildly acid acetate buffer clearly gives the highest clay yield, whereas the HCl treatment yields less clay than when no treatment is given. Either an unresolved interaction plays a role or it must be concluded that clay is being dissolved by HCl. The same analysis of variance was also carried out without the data for the Andosol since dispersion of these samples is very difficult (in fact, such samples should not be dried at all prior to analysis). In this case, the acetate buffer still gives significantly higher clay contents while the HCl and no-treatment give about the same results. Apparently, clay in Andosol is most susceptible to acid attack.

Three different types of *physical dispersion* are employed viz. shaking by hand, mechanical shaking and ultrasonic treatment, with the majority using mechanical shaking. Statistical analysis (Table 6.5) indicates no significant differences but the ultrasonic treatment appears to give some 10% higher clay contents.

Finally, three methods of *clay determination* can be distinguished: the pipette method (employed by 15 labs), the hydrometer (4 labs) and the sedimentometer (1 lab). Table 6.6 indicates that the hydrometer gives some 10% higher results than the pipette method (not statistically significant) whereas the sedimentometer gives significantly higher results (+40%).

4. CONCLUSIONS

The results obtained in this pilot round of a laboratory methods and data exchange program show that widely variable analytical results are obtained. Thus. if quantitative taxonomic systems for soil classification such as the FAO system or Soil Taxonomy are to be used globally, methods of soil analysis have to be standardized in detail. The present results indicate that such standardization is feasible but that probably relatively high minimum levels of variability have to be reckoned with. Consequently, taxonomic criteria for which these analyses are to be carried out have to be implemented flexibly.

From the present study such minimum levels can be estimated at (relative figures): ± 20% for CEC, ± 11% for clay content and ± 25% for CEC of the clay fraction.

5. RECOMMENDATIONS

Recommendations as to the choice of methods and details of procedures cannot be made at this stage. Such a choice has not only purely technical but also historical implications. A laboratory, quite satisfied with the procedure that has been in use for many years, might not be readily prepared to adapt. Further testing and correlation of methods by more laboratories seems to be the next step to take. The program also needs to be extended to other soil parameters such as base saturation, water dispersable clay and other. Also, the present set of "reference" samples could be improved and perhaps extended to 15 or so. The dried Ando samples, although yielding useful information, appeared not to be representative for the present purpose. Interesting would be to include some "boundary" samples e.g. between Oxisol and Ultisol and between Alfisol and Ultisol.

In any case, if work of this type is to have any practical application and implementation, some policy making committee should be set up.

Suggestions for improvement and extension of the program are invited.

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TABLE 1. Description of the reference samples.

No.	Location	Horizon	Depth (cm)	Classification
1.	Busia, Kenya	Ap	0- 15	Oxic Pale(?)udult/ferric Acrisol, petric phase
2.		Bt2	50- 70	
3.	Magarini, Kenya	A*	0- 22	Typic Eutrustox/rhodic Ferralsol
4.		B*	80-120	
5.	Bura-east, Kenya	A*	0- 20	Typic Natrargid/orthic Solonetz
6.	Nairobi, Kenya	Ap	0- 18	Orthoxic Palehumult/humic Nitosol
7.		Bt2	65-115	
8.	Kijabe, Kenya	Ah	0- 17	Udic Eutrandept/mollic Andosol
9.		B*	75-105	
10.	Randwijk, Netherlands	C*	60-110	Typic Fluvaquent/calcaric Fluvisol

* unspecified

TABLE 2.1 Analytical results and % deviation from the mean per soil.

CEC

Results (me/100g)

	Acrisol		Ferralsol		Solonetz	Nitosol		Andosol		Fluvisol
SOIL / LAB	1	2	3	4	5	6	7	8	9	10
1	4.9	6.5	2.1	2.8	20.1	17.3	12.0	44.3	20.3	6.4
2	3.4	3.4	1.3	2.1	18.9	8.9	8.3	13.7	9.5	7.0
3	2.9	7.2	2.2	2.8	17.2	23.2	12.5	49.5	26.0	11.4
4	5.6	6.5	3.0	3.0	25.3	18.3	12.4	43.3	25.1	12.5
5	4.9	6.6	2.5	3.1	22.3	19.7	13.5	70.5	28.9	9.0
6	4.7	6.3	2.0	2.4	22.5	18.4	12.3	63.4	25.9	8.0
7	2.8	4.4	1.1	1.3	15.5	16.1	11.6	57.1	27.1	6.5
8	4.5	5.8	2.0	2.4	20.7	17.8	12.1	55.5	25.2	7.8
9	3.4	4.9	1.8	2.0	24.7	9.6	8.1	12.2	14.4	27.1
10	6.0	7.0	3.0	3.0	24.0	22.6	13.0	62.0	31.0	12.0
11	4.9	6.9	2.3	2.8	22.7	20.3	13.7	65.1	29.8	9.5
12	5.4	7.6	2.7	4.9	23.2	25.6	22.4	62.0	44.8	11.4
13	7.2	8.4	3.7	3.9	22.0	24.3	19.7	72.9	41.1	10.4
14	6.5	8.1	3.6	4.2	23.1	23.7	18.7	54.1	37.6	8.9
15	5.8	4.5	2.0	1.5	24.0	11.4	8.4	43.6	17.3	20.6
16	5.0	6.5	2.9	3.3	19.4	20.1	16.3	42.9	32.6	8.2
17	5.3	8.8	2.9	2.9	18.5	19.8	15.0	50.1	30.4	9.4
18	5.4	8.8	2.8	4.3	20.2	24.2	22.5	67.3	51.0	7.3
19	4.9	6.5	2.3	2.7	22.8	18.3	12.6	71.7	26.3	11.6
20	6.4	8.6	3.3	4.6	21.7	22.2	19.1	57.1	29.8	9.9
Mean	5.0	6.7	2.5	3.0	21.4	19.1	14.2	52.9	28.7	10.7

% Deviation

1	2	3	4	5	6	7	8	9	10	Mean
-2	-3	-16	-7	-6	-9	-15	-16	-29	-40	-14
-32	-49	-48	-30	-12	-53	-42	-74	-67	-35	-44
-42	7	-12	-7	-20	21	-12	-6	-9	7	-7
12	-3	20	0	18	-4	-13	-18	-13	17	2
-2	-1	0	3	4	3	-5	33	1	-16	2
-6	-6	-20	-20	5	-4	-13	20	-10	-25	-8
-44	-34	-56	-57	-28	-16	-18	8	-6	-39	-29
-10	-13	-20	-20	-3	-7	-15	5	-12	-27	-12
-32	-27	-28	-33	15	-50	-43	-77	-50	153	-17
20	4	20	0	12	18	-8	17	8	12	10
-2	3	-8	-7	6	6	-4	23	4	-11	1
8	13	8	63	8	34	58	17	56	7	27
44	25	48	30	3	27	39	38	43	-3	29
30	21	44	40	8	24	32	2	31	-17	22
16	-33	-20	-50	12	-40	-41	-18	-40	93	-12
0	-3	16	10	-9	5	15	-19	14	-23	0.6
6	31	16	-3	-14	4	6	5	6	-12	5
8	31	12	43	-6	27	58	27	78	-32	25
-2	-3	-8	-10	7	-4	-11	36	-8	8	0.5
28	28	32	53	1	16	35	8	4	-7	20

CLAY CONTENT

wt%

SOIL / LAB	1	2	3	4	5	6	7	8	9	10
1	14	13	7	24	28	34	47	4	10	15
2	14	25	17	36	26	76	85	27	10	16
3	20	30	14	38	36	74	84	16	24	24
4	16	28	16	37	29	74	85	16	31	18
5	21	31	17	37	32	81	90	39	36	26
6	14	26	15	36	29	72	82	20	7	17
7	16	28	17	40	31	79	88	26	13	18
8	17	27	17	39	31	66	82	16	2	15
9	14	26	14	34	30	62	76	6	8	18
10	13	23	10	34	25	55	70	11	14	15
11	14	25	17	39	28	72	85	16	7	16
12	19	30	19	40	31	80	89	55	59	20
13	12	25	15	36	28	29	63	8	3	7
14	16	28	18	40	30	52	51	28	23	18
15	12	24	12	25	26	47	46	8	5	12
16	17	27	18	38	30	66	76	25	21	18
17	16	25	14	36	27	74	89	18	26	20
18	15	26	14	34	31	78	87	1	10	20
19	13	23	15	38	25	73	85	18	6	14
20	15	26	16	41	30	77	86	16	9	14
Mean	15.4	25.8	15.1	36.1	29.2	66.1	77.3	18.7	16.2	17.1

% Deviation

1	2	3	4	5	6	7	8	9	10	Mean
-9	-50	-54	-34	-4	-49	-39	-79	-38	-12	-37
-9	-3	13	0	-11	15	10	44	-38	-6	2
30	16	-7	5	23	12	9	-14	48	41	16
4	9	6	2	1	12	10	-14	91	6	13
36	20	13	2	10	23	16	109	122	53	40
-9	1	-1	0	-1	9	6	7	-57	0	-5
4	9	13	11	6	20	14	39	-20	6	10
10	5	13	8	6	0	6	-14	-88	-12	-7
-9	1	-7	-6	3	-6	-2	-68	-51	6	-14
-16	-11	-34	-6	-14	-17	-9	-41	-14	-12	-17
-9	-3	13	8	-4	9	10	-14	-57	-6	-5
23	16	26	11	6	21	15	194	264	18	59
-22	-3	-1	0	-4	-56	-18	-57	-81	-58	-30
4	9	19	11	3	-21	-34	50	42	6	9
-22	-7	-21	-31	-11	-29	-40	-57	-69	-29	-32
10	5	19	5	3	0	-2	34	30	6	11
4	-3	-7	0	-8	12	15	-4	60	18	9
-3	1	-7	-6	6	18	13	-95	-38	18	-9
-16	-11	-1	5	-14	10	10	-4	-63	-18	-10
-3	1	6	14	3	16	11	-14	-44	-18	-3

CEC of the CLAY

me/100g

SOIL / LAB	1	2	3	4	5	6	7	8	9	10
1	35	50	30	12	72	51	26	1108	203	43
2	24	14	8	6	73	12	10	51	95	44
3	15	24	16	7	48	31	15	309	108	48
4	35	23	19	8	87	25	15	271	81	69
5	23	21	15	8	70	24	15	181	80	35
6	34	24	13	7	78	26	15	317	370	47
7	18	16	7	3	50	20	13	220	209	36
8	27	22	12	6	67	27	15	347	1260	52
9	24	19	13	6	82	16	11	203	180	151
10	46	30	30	9	96	41	29	564	221	80
11	35	28	14	7	81	28	16	407	427	59
12	28	25	14	12	75	32	25	113	76	57
13	60	34	25	11	79	84	31	911	1370	149
14	41	29	20	11	77	46	37	193	164	49
15	48	19	17	6	92	24	18	545	346	172
16	29	24	16	9	65	31	21	172	155	46
17	33	35	21	8	69	27	17	278	117	47
18	36	34	20	13	65	31	26	6730	510	37
19	38	28	15	7	91	25	15	398	438	83
20	43	33	21	11	72	29	22	357	331	71
Mean	33.6	26.6	17.2	8.3	74.4	31.4	19.0	683	337	68.6

% Deviation

1	2	3	4	5	6	7	8	9	10	Mean
4	88	75	40	-3	62	34	62	-40	-38	28
-28	-49	-56	-30	-2	-63	-49	-93	-72	-36	-48
-57	-10	-8	-11	-36	0	-22	-55	-68	-31	-30
4	-13	10	-3	17	-21	-23	-60	-76	1	-16
-31	-20	-14	1	-6	-23	-21	-74	-76	-50	-31
0	-9	-22	-20	4	-19	-21	-54	10	-31	-16
-48	-41	-62	-62	-33	-35	-31	-68	-38	-47	-46
-21	-19	-31	-26	-10	-14	-22	-49	274	-24	6
-28	-29	-25	-29	11	-51	-44	-70	-47	119	-19
38	14	75	6	29	31	-2	-18	-34	17	15
4	4	-21	-14	9	-10	-15	-40	26	-13	-7
-15	-5	-17	47	1	2	32	-84	-77	-17	-13
79	26	44	29	6	167	64	33	307	117	87
21	9	17	26	4	45	93	-72	-51	-28	6
44	-29	-3	-28	24	-23	-4	-20	3	150	11
-12	-9	-6	4	-13	-3	12	-75	-54	-34	-19
-1	32	21	-3	-8	-15	-11	-59	-65	-32	-14
7	27	17	51	-12	-1	36	884	51	-47	101
12	7	-11	-15	23	-20	-22	-42	30	21	-2
27	25	20	34	-3	-8	17	-48	-2	3	6

TABLE 2.2 Analytical results (cont'd).

SILT 1 CONTENT (2-20 μm)

wt%

SOIL / LAB	Acrisol 1	Acrisol 2	Ferralsol 3	Ferralsol 4	Solonetz 5	Nitosol 6	Nitosol 7	Andosol 8	Andosol 9	Fluvisol 10
1	19	28	5.0	7.4	11	29	24	31	33	21
2	17	17	0.9	1.3	9	12	7	34	33	21
3										
4										
5	16	16	1.0	1.0	9	9	4	38	50	23
6	19	20	2.0	2.5	13	18	12	48	49	22
7	19	19	0.7	0.7	11	11	6	45	52	23
8	17	16	0.1	0.3	11	20	11	50	31	24
9										
10	18	18	6.5	3.5	13	26	15	40	39	21
11	18	18	0.4	1.2	11	16	8	47	41	22
12	15	16	1.3	1.4	12	9	5	25	27	22
13	20	19	1.6	1.8	12	52	26	64	73	30
14	19	18	1.5	1.5	10	27	26	41	42	22
15										
16										
17										
18	21	19	2.0	1.0	12	12	7	2	51	23
19	20	16	1.3	1.5	15	15	9	37	55	17
20										
Mean	18.3	18.5	1.9	1.9	11.5	19.7	12.3	38.6	44.3	22.4

% Deviation

1	2	3	4	5	6	7	8	9	10	Mean
4	52	157	283	-4	47	95	-20	-26	-6	58
-7	-8	-54	-33	-22	-39	-43	-12	-26	-6	-25
-13	-13	-49	-48	-22	-54	-68	-2	13	3	-25
4	8	3	30	13	-9	-3	24	11	-2	8
4	3	-64	-64	-4	-44	-51	17	17	3	-18
-7	-13	-95	-85	-4	2	-11	30	-30	7	-21
										-21
-2	-2	234	81	13	32	22	4	-12	-6	36
-2	-2	-79	-38	-4	-19	-35	22	-7	-2	-17
-18	-13	-33	-28	5	-54	-59	-35	-39	-2	-28
9	3	34	-7	5	164	111	66	65	34	48
4	-2	-23	-22	-13	37	111	6	-5	-2	9
15	3	3	-48	5	-39	-43	-95	15	3	-18
9	-13	-33	-22	31	-24	-27	-4	24	-24	-8

SILT 2 CONTENT (2-50 μm)

wt%

SOIL / LAB	1	2	3	4	5	6	7	8	9	10
1										
2										
3	24	24	2.0	2.0	4	12	8	40	36	28
4	33	31	3.0	1.0	14	20	11	71	57	51
5	26	23	1.0	2.0	10	12	6	49	56	42
6	32	30	3.0	3.0	14	22	15	62	75	48
7	32	29	0.9	0.9	13	15	9	57	78	46
8										
9	30	22	2.0	4.0	8	16	8	40	40	42
10	34	29	7.0	4.3	14	30	17	50	56	45
11	30	28	0.8	2.0	13	20	11	61	54	44
12	30	29	2.2	2.1	16	13	8	36	34	49
13	33	30	3.4	2.6	13	63	36	78	88	53
14	31	27	2.0	2.0	13	34	37	53	57	47
15	33	30	4.0	16	17	42	35	50	33	46
16	28	28	1.5	1.4	12	24	20	52	67	40
17	30	32	1.0	1.0	13	18	7	67	62	53
18	35	30	2.8	2.4	14	15	10	73	69	49
19	31	30	5.9	2.6	15	19	10	61	76	45
20	31	28	0.8	0.6	13	16	11	69	83	49
Mean	30.8	28.2	2.5	2.9	12.7	23.0	15.2	57.0	60.1	45.7

% Deviation

1	2	3	4	5	6	7	8	9	10	Mean
-22	-15	-22	-31	-69	-48	-48	-30	-40	-39	-36
7	10	18	-65	10	-13	-28	25	-5	12	-3
-16	-19	-61	-31	-21	-48	-61	-14	-7	-8	-28
4	6	18	4	10	-4	-2	9	25	5	8
4	3	-65	-69	2	-35	-41	0	30	1	17
-3	-22	-22	39	-37	-30	-48	-30	-33	-8	-19
10	3	175	50	10	30	12	-12	-7	-2	27
-3	-1	-69	-31	2	-13	-28	7	-10	-4	-15
-3	3	-14	-27	26	-43	-48	-37	-43	7	-18
7	6	34	-10	2	174	136	37	47	16	45
1	-4	-22	-31	2	48	143	-7	-5	3	13
7	6	57	456	34	83	130	-12	-45	1	72
-9	-1	-41	-51	-6	4	31	-9	12	-13	-8
-3	13	-61	-65	2	-22	-54	18	3	16	-15
14	6	10	-17	10	-35	-34	28	15	7	0.5
1	6	132	-44	18	-17	-34	7	27	-2	9
1	-1	-69	-79	2	-30	-28	21	38	7	-14

SILT 1 / CLAY ratio

Ratio

SOIL / LAB	1	2	3	4	5	6	7	8	9	10
1	1.36	2.15	0.71	0.31	0.39	0.85	0.51	7.75	3.30	1.40
2	1.21	0.68	0.05	0.04	0.35	0.16	0.08	1.26	3.30	1.31
3										
4										
5	0.76	0.52	0.06	0.03	0.28	0.11	0.04	0.97	1.39	0.88
6	1.36	0.77	0.13	0.07	0.45	0.25	0.15	2.40	7.00	1.29
7	1.19	0.68	0.04	0.02	0.35	0.14	0.07	1.73	4.00	1.28
8	1.00	0.59	0.01	0.01	0.35	0.30	0.13	3.13	15.5	1.60
9										
10	1.38	0.78	0.65	0.10	0.52	0.47	0.21	3.64	2.79	1.40
11	1.29	0.72	0.02	0.03	0.39	0.22	0.09	2.94	5.86	1.38
12	0.79	0.53	0.07	0.04	0.39	0.11	0.06	0.45	0.46	1.10
13	1.67	0.76	0.17	0.05	0.43	1.79	0.41	8.00	24.3	4.29
14	1.19	0.64	0.08	0.04	0.33	0.52	0.51	1.46	1.83	1.22
15										
16										
17										
18	1.40	0.73	0.14	0.03	0.39	0.15	0.08	2.00	5.10	1.15
19	1.54	0.70	0.09	0.04	0.60	0.21	0.11	2.06	9.17	1.21
20										
Mean	1.24	0.79	0.17	0.06	0.40	0.41	0.19	2.91	6.46	1.50

% Deviation

1	2	3	4	5	6	7	8	9	10	Mean
9	173	316	406	-2	109	170	167	-49	-7	129
-2	-14	-69	-41	-14	-61	-56	-57	-49	-13	-38
-39	-35	-66	-56	-30	-73	-77	-66	-79	-41	-56
9	-3	-22	14	11	-39	-23	-17	8	-14	-7
-4	-14	-76	-71	-12	-66	-64	-40	-38	-15	-40
-19	-25	-97	-87	-12	-26	-29	8	140	7	-14
12	-1	278	69	29	16	13	25	-57	-7	38
4	-9	-86	-49	-2	-45	-50	1	-9	-8	-26
-36	-32	-60	-43	-4	-72	-70	-84	-93	-27	-52
34	-4	1	-18	7	340	118	175	277	185	111
-4	-19	-52	-38	-17	28	169	-50	-72	-19	-7
13	-7	-17	-52	-4	-62	-57	-31	-21	-23	-26
24	-12	-50	-35	49	-50	-44	-29	42	-19	-12

TABLE 2.3 Analytical results (cont'd).

SILT 2 / CLAY ratio

Ratio

SOIL / LAB	Acrisol 1	Acrisol 2	Ferralsol 3	Ferralsol 4	Solonetz 5	Nitosol 6	Nitosol 7	Andosol 8	Andosol 9	Fluvisol 10
1										
2										
3	1.20	0.80	0.14	0.05	0.11	0.16	0.10	2.50	1.50	1.17
4	2.06	1.11	0.19	0.03	0.48	0.27	0.13	4.44	1.84	2.83
5	1.24	0.74	0.06	0.05	0.31	0.15	0.07	1.26	1.56	1.62
6	2.29	1.15	0.20	0.08	0.48	0.31	0.18	3.10	10.7	2.82
7	2.00	1.04	0.05	0.02	0.42	0.19	0.10	2.19	6.00	2.56
8										
9	2.14	0.85	0.14	0.12	0.27	0.26	0.11	6.67	5.00	2.33
10	2.62	1.26	0.70	0.13	0.56	0.55	0.24	4.55	4.00	3.00
11	2.14	1.12	0.05	0.05	0.46	0.28	0.13	3.81	7.71	2.75
12	1.58	0.97	0.12	0.05	0.52	0.16	0.09	0.65	0.58	2.45
13	2.75	1.20	0.23	0.07	0.46	2.17	0.57	9.75	29.3	7.57
14	1.94	0.96	0.11	0.05	0.43	0.65	0.73	1.89	2.48	2.61
15	2.75	1.25	0.33	0.64	0.65	0.89	0.76	6.25	6.60	3.83
16	1.65	1.04	0.08	0.04	0.40	0.36	0.26	2.08	3.19	2.22
17	1.88	1.28	0.07	0.03	0.48	0.24	0.08	3.72	2.38	2.65
18	2.33	1.15	0.20	0.07	0.45	0.19	0.11	73.0	6.90	2.45
19	2.38	1.30	0.39	0.04	0.60	0.26	0.12	3.39	12.7	3.21
20	2.07	1.08	0.05	0.01	0.43	0.21	0.13	4.31	9.22	3.50
Mean	2.06	1.08	0.18	0.09	0.44	0.43	0.23	7.86	6.57	2.92

% Deviation

1	2	3	4	5	6	7	8	9	10	Mean
-42	-26	-22	-42	-75	-62	-59	-68	-77	-60	-53
0	3	2	-70	9	-37	-44	-44	-72	-3	-26
-40	-31	-68	-40	-29	-66	-71	-84	-76	-45	-55
11	7	9	-8	9	-29	-20	-61	63	-3	-2
-3	-4	-71	-75	-5	-56	-55	-72	-9	-12	-36
4	-21	-22	30	-40	-40	-54	-15	-24	-20	-20
27	17	282	39	26	27	6	-42	-39	3	35
4	4	-74	-43	5	-35	-44	-51	17	-6	-22
-23	-10	-37	-42	16	-62	-61	-92	-91	-16	-42
34	11	24	-20	5	405	149	24	347	160	114
-6	-10	-39	-45	-2	52	216	-76	-62	-10	2
34	16	82	606	48	108	231	-20	0	31	114
-20	-4	-55	-59	-10	-15	15	-74	-51	-24	-20
-9	19	-61	-69	9	-43	-66	-53	-64	-9	-35
13	7	9	-22	2	-55	-50	829	5	-16	72
16	21	114	-54	35	-39	-49	-57	93	10	9
0	0	-73	-84	-2	-52	-44	-45	40	20	-24

SAND 1 CONTENT (20-2000 μm)

wt%

SOIL / LAB	1	2	3	4	5	6	7	8	9	10
1	67	59	88	69	61	38	30	64	58	64
2	69	57	82	63	65	12	8	39	57	63
3										
4										
5	62	53	82	62	59	10	6	23	14	51
6	67	55	83	62	59	11	7	32	44	61
7	66	54	82	60	58	10	7	29	35	59
8	66	57	82	61	57	14	7	34	67	61
9										
10	68	56	83	61	57	11	6	31	31	62
11	68	56	83	61	61	13	7	38	53	62
12	66	54	80	59	57	11	6	21	14	58
13	68	56	83	62	60	19	11	27	24	63
14	64	55	81	59	60	21	22	31	36	60
15										
16										
17										
18	64	55	84	65	57	10	6	97	39	57
19	67	61	84	61	60	12	6	45	39	69
20										
Mean	66.3	56.0	82.8	61.9	59.3	11.8	9.9	39.3	39.3	60.7

% Deviation

1	2	3	4	5	6	7	8	9	10	Mean
1	5	6	11	3	157	202	63	48	5	50
4	2	-1	2	10	-19	-19	-1	45	4	3
-6	-5	-1	0	-1	-32	-40	-41	-64	-16	-21
1	-2	0	0	-1	-26	-29	-19	12	0	-6
0	-4	-1	-3	-2	-32	-29	-26	-11	-3	-11
0	2	-1	-1	-4	-5	-29	-14	70	0	2
3	0	0	-1	-4	-26	-40	-21	-21	2	-11
3	0	0	-1	3	-12	-29	-3	35	2	-0.2
0	-4	-3	-5	-4	-26	-40	-47	-64	-5	-20
3	0	0	0	1	29	11	-31	-39	4	-2
-3	-2	-2	-5	1	42	122	-21	-8	-1	12
-3	-2	1	5	-4	-32	-40	147	-1	-6	7
1	9	1	-1	1	-19	-40	14	-1	14	-2

SAND 2 CONTENT (50-2000 μm)

wt%

SOIL / LAB	1	2	3	4	5	6	7	8	9	10
1										
2										
3	56	46	82	60	60	14	8	44	40	48
4	51	41	81	62	57	6	4	13	12	31
5	53	46	82	61	58	7	4	12	8	32
6	54	45	82	61	57	7	4	19	18	35
7	53	44	82	59	56	7	4	17	9	36
8										
9	56	52	84	62	62	22	16	54	52	40
10	52	45	82	60	56	7	4	21	14	38
11	56	47	83	60	59	8	4	24	40	40
12	51	41	79	59	54	6	3	10	8	32
13	54	46	82	61	58	8	4	14	9	40
14	52	45	80	58	57	14	11	20	20	35
15	54	46	84	58	57	11	19	42	62	41
16	55	45	81	61	59	9	4	23	12	42
17	55	43	85	63	60	8	5	15	12	27
18	50	44	83	64	55	7	4	26	21	32
19	56	47	79	60	60	8	5	21	18	41
20	54	46	83	59	57	7	4	15	9	37
Mean	53.6	45.2	82.0	60.5	57.8	9.2	6.3	22.9	21.4	36.9

% Deviation

1	2	3	4	5	6	7	8	9	10	Mean
4	2	0	-1	4	53	27	92	87	30	30
-5	-9	-1	3	-1	-35	-36	-43	-44	-16	-19
-1	2	0	1	0	-24	-36	-48	-63	-13	-18
1	-1	0	1	-1	-24	-36	-17	-16	-5	-10
-1	-3	0	-2	-3	-24	-36	-26	-58	-2	-16
4	15	2	3	7	140	154	135	143	8	61
-3	-1	0	-1	-3	-24	-36	-8	-35	3	-11
4	4	1	-1	2	-13	-36	5	87	8	6
-5	-9	-4	-2	-7	-35	-52	-56	-63	-13	-25
1	2	0	1	0	-13	-36	-39	-58	8	-13
-3	-1	-2	-4	-1	53	75	-13	-7	-5	9
1	2	2	-4	-1	20	202	83	190	11	51
3	-1	-1	1	2	-2	-36	0	-44	14	-6
3	-5	4	4	4	-13	-21	-35	-44	-27	-13
-7	-3	1	6	-5	-24	-36	13	-2	-13	-7
4	4	-4	-1	4	-13	-21	-8	-16	11	-4
1	2	1	-2	-1	-24	-36	-35	-58	0	-15

TABLE 3. Analysis of variance of the DATA per SOIL.

These tables give the mean values of all parameters of each soil as obtained by all laboratories.
Thus, these are the reference values characterizing the soils.
They show that the soils are very significantly different (1% level) for all parameters.

TABLE 3.1

Variable: CEC

by Variable, SOIL

CEC

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.
Between groups	9	43049.5041	4783.2783	105.531	0.0000
Within groups	190	8611.9410	45.3260		
Total	199	51661.4453			

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean
GRP001	20	4.9950	1.1745	0.2626	2.8000	7.2000	4.4453 to 5.5447
GRP002	20	6.6650	1.5191	0.3397	3.4000	8.8000	5.9540 to 7.3760
GRP003	20	2.4750	0.6958	0.1556	1.1000	3.7000	2.1494 to 2.8006
GRP004	20	3.0000	0.9760	0.2182	1.3000	4.9000	2.5432 to 3.4568
GRP005	20	21.4400	2.5810	0.5771	15.5000	25.3000	20.2321 to 22.6479
GRP006	20	19.0900	4.7445	1.0609	8.9000	25.6000	16.8695 to 21.3105
GRP007	20	14.2100	4.3032	0.9622	8.1000	22.5000	12.1960 to 16.2240
GRP008	20	52.9150	16.7078	3.7360	12.2000	72.9000	45.0955 to 60.7345
GRP009	20	28.7050	9.8345	2.1991	9.5000	51.0000	24.1023 to 33.3077
GRP010	20	10.7450	4.9576	1.1085	6.4000	27.1000	8.4248 to 13.0652
Total	200	16.4240	16.1123	1.1393	1.1000	72.9000	14.1773 to 18.6707

- O N E W A Y -

Variable: CLAY

by Variable SOIL

CLAY

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.
Between groups	9	89701.5059	9966.8340	116.066	0.0000
Within groups	190	16315.6500	85.8718		
Total	199	106017.1600			

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean
GRP01	20	15.4000	2.4794	0.5544	12.0000	21.0000	14.2396 to 16.5604
GRP02	20	25.8000	3.7360	0.8354	13.0000	31.0000	24.0515 to 27.5485
GRP03	20	15.1000	2.8819	0.6444	7.0000	19.0000	13.7512 to 16.4488
GRP04	20	36.1000	4.4827	1.0024	24.0000	41.0000	34.0020 to 38.1980
GRP05	20	29.1500	2.6611	0.5950	25.0000	36.0000	27.9046 to 30.3954
GRP06	20	66.0500	15.1396	3.3853	29.0000	81.0000	58.9644 to 73.1356
GRP07	20	77.3000	14.3200	3.2021	46.0000	90.0000	70.5980 to 84.0020
GRP08	20	18.7000	12.5577	2.8080	1.0000	55.0000	12.8228 to 24.5772
GRP09	20	16.2000	13.9420	3.1175	2.0000	59.0000	9.6750 to 22.7250
GRP10	20	17.0500	4.0972	0.9162	7.0000	26.0000	15.1325 to 18.9675
Total	200	31.6850	23.0814	1.6321	1.0000	90.0000	28.4666 to 34.9034

TABLE 3.2

ONEWAY

Variable: CECCLAY
by Variable SOIL

CEC/Clay

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.
Between groups	9	8516517.6904	946279.7400	4.256	0.0000
Within groups	190	42246234.8109	222348.6000		
Total	199	50762753.0000			

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP01	20	33.5700	10.8348	2.4227	14.5000	60.0000	28.4991	to	38.6409
GRP02	20	26.5700	8.2201	1.8381	13.6000	50.0000	22.7229	to	30.4171
GRP03	20	17.1550	6.2057	1.3876	6.5000	30.0000	14.2506	to	20.0594
GRP04	20	8.3350	2.5107	0.5614	3.2000	12.6000	7.1600	to	9.5100
GRP05	20	74.3800	12.5352	2.8030	47.8000	96.0000	68.5133	to	80.2467
GRP06	20	31.4350	15.3237	3.4265	11.7000	83.8000	24.2633	to	38.6067
GRP07	20	19.0450	6.9317	1.5500	9.8000	36.7000	15.8008	to	22.2892
GRP08	20	683.6750	1446.2163	323.3838	50.7000	6730.0000	6.8250	to	1360.5251
GRP09	20	337.0050	360.0315	80.5055	75.9000	1370.0000	168.5051	to	505.5049
GRP10	20	68.6300	40.6448	9.0885	34.6000	171.7000	49.6076	to	87.6524
Total	200	129.9800	505.0636	35.7134	3.2000	6730.0000	59.5548	to	200.4053

TABLE 3.3

ONEWAY

Variable: SILT1
by Variable SOIL

SILT 1

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.
Between groups	9	22382.3632	2486.9293	40.978	0.0000
Within groups	120	7282.7723	60.6898		
Total	129	29665.1350			

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean
GRP01	13	18.3077	1.7022	0.4721	15.0000	21.0000	17.2791 to 19.3363
GRP02	13	18.4615	3.1785	0.8815	16.0000	28.0000	16.5408 to 20.3823
GRP03	13	1.9462	1.8455	0.5119	0.1000	6.5000	0.8309 to 3.0614
GRP04	13	1.9308	1.8305	0.5077	0.3000	7.4000	0.8246 to 3.0369
GRP05	13	11.4615	1.6641	0.4615	9.0000	15.0000	10.4559 to 12.4671
GRP06	13	19.6923	11.8489	3.2863	9.0000	52.0000	12.5321 to 26.8526
GRP07	13	12.3077	8.0040	2.2199	4.0000	26.0000	7.4709 to 17.1445
GRP08	13	38.6154	14.6886	4.0739	2.0000	64.0000	29.7391 to 47.4916
GRP09	13	44.3077	12.4926	3.4648	27.0000	73.0000	36.7585 to 51.8569
GRP10	13	22.3846	2.8442	0.7889	17.0000	30.0000	20.6659 to 24.1034
Total	130	18.9415	15.1645	1.3300	0.1000	73.0000	16.3101 to 21.5730

ONEWAY

Variable: SILT2
by Variable SOIL

SILT 2

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.
Between groups	9	66138.6228	7348.7358	91.340	0.0000
Within groups	160	12872.7295	80.4546		
Total	169	79011.3530			

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean
GRP01	17	30.7647	2.7957	0.6781	24.0000	35.0000	29.3273 to 32.2021
GRP02	17	28.2353	2.7957	0.6781	22.0000	32.0000	26.7979 to 29.6727
GRP03	17	2.5471	1.7696	0.4292	0.8000	7.0000	1.6372 to 3.4569
GRP04	17	2.8765	3.5307	0.8563	0.6000	16.0000	1.0612 to 4.6918
GRP05	17	12.7059	3.0365	0.7365	4.0000	17.0000	11.1446 to 14.2671
GRP06	17	23.0000	13.1339	3.1854	12.0000	63.0000	16.2472 to 29.7528
GRP07	17	15.2353	10.5447	2.5575	6.0000	37.0000	9.8137 to 20.6569
GRP08	17	57.0000	12.2882	2.9803	36.0000	78.0000	50.6820 to 63.3180
GRP09	17	60.0588	17.1736	4.1652	33.0000	88.0000	51.2290 to 68.8887
GRP10	17	45.7059	5.8712	1.4240	28.0000	53.0000	42.6872 to 48.7246
Total	170	27.8129	21.6223	1.6584	0.6000	88.0000	24.5392 to 31.0867

TABLE 3.4

- O N E W A Y -

Variable: SI1CLAY
by Variable SOIL

SILT 1/CLAY ratio

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.
Between groups	9	455.7528	50.6392	9.850	0.0000
Within groups	120	616.9319	5.1411		
Total	129	1072.6847			

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean
GRP01	13	1.2408	0.2650	0.0735	0.7619	1.6667	1.0807 to 1.4009
GRP02	13	0.7889	0.4188	0.1162	0.5161	2.1538	0.5358 to 1.0420
GRP03	13	0.1719	0.2318	0.0643	0.0059	0.7143	0.0318 to 0.3119
GRP04	13	0.0609	0.0781	0.0217	0.0077	0.3083	0.0137 to 0.1081
GRP05	13	0.4021	0.0834	0.0231	0.2813	0.6000	0.3517 to 0.4525
GRP06	13	0.4072	0.4672	0.1296	0.1111	1.7931	0.1248 to 0.6895
GRP07	13	0.1892	0.1718	0.0476	0.0444	0.5106	0.0854 to 0.2930
GRP08	13	2.9067	2.3754	0.6588	0.4545	8.0000	1.4713 to 4.3422
GRP09	13	6.4627	6.6693	1.8497	0.4576	24.3333	2.4325 to 10.4929
GRP10	13	1.5012	0.8540	0.2369	0.8846	4.2857	0.9852 to 2.0173
Total	130	1.4132	2.8836	0.2529	0.0059	24.3333	0.9128 to 1.9136

- O N E W A Y -

Variable: SI2CLAY
by Variable SOIL

SILT 2/CLAY ratio

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.
Between groups	9	1215.4630	135.0514	4.023	0.0001
Within groups	160	5371.6835	33.5730		
Total	169	6587.1465			

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean
GRP01	17	2.0594	0.4593	0.1114	1.2000	2.7500	1.8233 to 2.2956
GRP02	17	1.0764	0.1690	0.0410	0.7419	1.3043	0.9895 to 1.1633
GRP03	17	0.1834	0.1659	0.0402	0.0471	0.7000	0.0981 to 0.2687
GRP04	17	0.0907	0.1449	0.0351	0.0146	0.6400	0.0162 to 0.1652
GRP05	17	0.4431	0.1262	0.0306	0.1111	0.6538	0.3783 to 0.5080
GRP06	17	0.4298	0.4913	0.1192	0.1481	2.1724	0.1772 to 0.6824
GRP07	17	0.2296	0.2268	0.0550	0.0667	0.7609	0.1130 to 0.3463
GRP08	17	7.8566	16.9330	4.1069	0.6545	73.0000	-0.8496 to 16.5627
GRP09	17	6.5691	6.8246	1.6552	0.5763	29.3333	3.0602 to 10.0780
GRP10	17	2.9165	1.3531	0.3282	1.1667	7.5714	2.2208 to 3.6122
Total	170	2.1855	6.2432	0.4788	0.0146	73.0000	1.2402 to 3.1307

TABLE 3.5

Variable: SAND1
by Variable SOIL

SAND 1

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.
Between groups	9	62302.4924	6922.4991	81.431	0.0000
Within groups	120	10201.2308	85.0103		
Total	129	72503.7240			

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP01	13	66.3077	1.9742	0.5475	62.0000	69.0000	65.1147	to	67.5007
GRP02	13	56.0000	2.1602	0.5991	53.0000	61.0000	54.6946	to	57.3054
GRP03	13	82.8462	1.9081	0.5292	80.0000	88.0000	81.6931	to	83.9992
GRP04	13	61.9231	2.6602	0.7378	59.0000	69.0000	60.3155	to	63.5306
GRP05	13	59.3077	2.2871	0.6343	57.0000	65.0000	57.9256	to	60.6898
GRP06	13	14.7692	7.7798	2.1577	10.0000	38.0000	10.0679	to	19.4705
GRP07	13	9.9231	7.4438	2.0645	6.0000	30.0000	5.4248	to	14.4213
GRP08	13	39.3077	20.5158	5.6901	21.0000	97.0000	26.9101	to	51.7053
GRP09	13	39.3077	16.4640	4.5663	14.0000	67.0000	29.3586	to	49.2568
GRP10	13	60.7692	4.2062	1.1666	51.0000	69.0000	58.2274	to	63.3110
Total	130	49.0462	23.7075	2.0793	6.0000	97.0000	44.9322	to	53.1601

- O N E W A Y -

Variable: SAND2
by Variable SOIL

SAND 2

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.
Between groups	9	92530.2870	10281.1430	199.657	0.0000
Within groups	160	8239.0588	51.4941		
Total	169	100769.3500 .			

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP01	17	53.6471	1.9346	0.4692	50.0000	56.0000	52.6524	to	54.6417
GRP02	17	45.2353	2.4882	0.6035	41.0000	52.0000	43.9560	to	46.5146
GRP03	17	82.0000	1.6583	0.4022	79.0000	85.0000	81.1474	to	82.8526
GRP04	17	60.4706	1.6627	0.4033	58.0000	64.0000	59.6157	to	61.3255
GRP05	17	57.7647	2.0472	0.4965	54.0000	62.0000	56.7121	to	58.8173
GRP06	17	9.1765	4.0963	0.9935	6.0000	22.0000	7.0704	to	11.2826
GRP07	17	6.2941	4.6605	1.1303	3.0000	19.0000	3.8979	to	8.6903
GRP08	17	22.9412	12.3515	2.9957	10.0000	54.0000	16.5906	to	29.2917
GRP09	17	21.4118	16.6623	4.0412	8.0000	62.0000	12.8448	to	29.9787
GRP10	17	36.8824	5.1585	1.2511	27.0000	48.0000	34.2301	to	39.5346
Total	170	39.5824	24.4186	1.8728	3.0000	85.0000	35.8852	to	43.2795

TABLE 4. Analysis of variance of proportional (%) DEVIATIONS from the mean per soil versus SOILS.

This analysis is not meant to be a test for significance (the mean of deviations = 0 for all soils)* but gives information on the "difficulty" of the soils. This is expressed by the "noise" of the deviation distribution: the lower the standard deviation and standard error, the higher the agreement between the labs and thus, the "easier" the soil is for that parameter. Minimum and maximum values and the 95% confidence interval for the mean further illustrate this.

* slight errors introduced by rounding off

TABLE 4.1

ONEWAY

PERC. DIFF. CEC

Variable: CEC
by Variable SOIL

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.
Between groups	9	38.6800	4.2978	0.005	1.0000
Within groups	190	168914.6002	889.0242		
Total	199	168953.2800			

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean
GRP01	20	-0.1000	23.4900	5.2525	-44.0000	44.0000	-11.0936 to 10.8936
GRP02	20	-0.6000	22.5071	5.0327	-49.0000	31.0000	-11.1336 to 9.9336
GRP03	20	-1.0000	27.8303	6.2230	-56.0000	48.0000	-14.0250 to 12.0250
GRP04	20	-0.1000	32.4684	7.2602	-57.0000	63.0000	-15.2957 to 15.0957
GRP05	20	0.0500	12.1112	2.7082	-28.0000	18.0000	-5.6182 to 5.7182
GRP06	20	-0.1000	24.7512	5.5345	-53.0000	34.0000	-11.6839 to 11.4839
GRP07	20	0.1500	30.3788	6.7929	-43.0000	58.0000	-14.0677 to 14.3677
GRP08	20	0.5500	31.5786	7.0612	-77.0000	38.0000	-14.2292 to 15.3292
GRP09	20	0.0500	34.3227	7.6748	-67.0000	78.0000	-16.0135 to 16.1135
GRP10	20	0.5000	46.3221	10.3579	-40.0000	153.0000	-21.1794 to 22.1794
Total	200	-0.0600	29.1378	2.0604	-77.0000	153.0000	-4.1229 to 4.0029

ONEWAY

PERC. DIFF. CLAY

Variable: CLAY
by Variable SOIL

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.
Between groups	9	3.1050	0.3450	0.000	1.0000
Within groups	190	274137.6519	1442.8297		
Total	199	274140.7600			

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean
GRP01	20	-0.1000	16.0457	3.5879	-22.0000	36.0000	-7.6096 to 7.4096
GRP02	20	0.1000	14.5743	3.2589	-50.0000	20.0000	-6.7210 to 6.9210
GRP03	20	0.0500	19.2312	4.3002	-54.0000	26.0000	-8.9505 to 9.0505
GRP04	20	-0.0500	12.5350	2.8074	-34.0000	14.0000	-5.9259 to 5.8259
GRP05	20	-0.0500	9.0523	2.0242	-14.0000	23.0000	-4.2866 to 4.1866
GRP06	20	-0.0500	22.9564	5.1332	-56.0000	23.0000	-10.7939 to 10.6939
GRP07	20	0.0500	18.4033	4.1151	-40.0000	16.0000	-8.5630 to 8.6630
GRP08	20	0.1000	67.1839	15.0228	-95.0000	194.0000	-31.3430 to 31.5430
GRP09	20	-0.0500	85.9703	19.2235	-88.0000	264.0000	-40.2853 to 40.1853
GRP10	20	0.3500	24.0576	5.3794	-58.0000	53.0000	-10.9093 to 11.6093
Total	200	0.0350	37.1159	2.6245	-95.0000	264.0000	-5.1404 to 5.2104

TABLE 4.2

ONEWAY

Variable: CECCLAY
by Variable SOIL

PERC. DIFF. CEC/CLAY.

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.
Between groups	9	0.0965	0.0107	0.000	1.0000
Within groups	190	1289433.8610	6786.4940		
Total	199	1289434.0000			

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean
GRP01	20	-0.0000	32.2754	7.2170	-56.8067	78.7310	-15.1053 to 15.1053
GRP02	20	-0.0000	30.9374	6.9178	-48.8145	88.1822	-14.4792 to 14.4792
GRP03	20	0.0292	36.1850	8.0912	-62.0991	74.9271	-16.9059 to 16.9642
GRP04	20	-0.0600	30.1039	6.7314	-61.6307	51.0791	-14.1490 to 14.0291
GRP05	20	0.0000	16.8530	3.7684	-35.7354	29.0670	-7.8874 to 7.8874
GRP06	20	-0.0159	48.7395	10.8985	-62.7863	166.5394	-22.8267 to 22.7949
GRP07	20	-0.0262	36.3870	8.1364	-48.5564	92.6509	-17.0559 to 17.0034
GRP08	20	-0.0007	211.5341	47.3005	-92.5842	884.3787	-99.0017 to 99.0003
GRP09	20	-0.0015	106.8311	23.8882	-77.4784	306.5161	-50.0000 to 49.9970
GRP10	20	-0.0000	59.2231	13.2427	-49.5847	150.1821	-27.7173 to 27.7173
Total	200	-0.0075	80.4958	5.6919	-92.5842	884.3787	-11.2317 to 11.2167

TABLE 4.3

---------- O N E W A Y ----------

Variable: PERSI1
by Variable SOIL

% diff. SILT 1

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.
Between groups	9	0.0001	0.0000	0.000	0.0000
Within groups	120	345922.0253	2882.6835		
Total	129	345922.0300			

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean
GRP01	13	-0.0000	9.2976	2.5787	-18.0673	14.7058	-5.6186 to 5.6185
GRP02	13	0.0002	17.2167	4.7750	-13.3332	51.6670	-10.4037 to 10.4041
GRP03	13	-0.0024	94.8280	26.3005	-94.8618	233.9842	-57.3063 to 57.3016
GRP04	13	-0.0016	94.8040	26.2939	-84.4624	283.2608	-57.2911 to 57.2879
GRP05	13	0.0003	14.5190	4.0269	-21.4762	30.8729	-8.7734 to 8.7741
GRP06	13	0.0000	60.1704	16.6883	-54.2969	164.0626	-36.3606 to 36.3607
GRP07	13	-0.0001	65.0325	18.0368	-67.5000	111.2499	-39.2988 to 39.2987
GRP08	13	-0.0000	38.0383	10.5499	-94.8207	65.7370	-22.9864 to 22.9863
GRP09	13	-0.0000	28.1950	7.8199	-39.0625	64.7569	-17.0381 to 17.0381
GRP10	13	0.0001	12.7063	3.5241	-24.0549	34.0207	-7.6783 to 7.6784
Total	130	-0.0003	51.7838	4.5417	-94.8618	283.2608	-8.9863 to 8.9856

---------- O N E W A Y ----------

Variable: PERSI2
by Variable SOIL

% diff. SILT 2

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.
Between groups	9	0.0000	0.0000	0.000	1.0000
Within groups	160	482282.9515	3014.2684		
Total	169	482282.9500			

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean
GRP01	17	0.0000	9.0875	2.2040	-21.9885	13.7668	-4.6723 to 4.6724
GRP02	17	-0.0000	9.9016	2.4015	-22.0834	13.3333	-5.0909 to 5.0909
GRP03	17	-0.0016	69.4741	16.8499	-68.5917	174.8223	-35.7219 to 35.7187
GRP04	17	-0.0010	122.7420	29.7693	-79.1413	456.2315	-63.1091 to 63.1071
GRP05	17	-0.0001	23.8987	5.7963	-68.5186	33.7961	-12.2877 to 12.2874
GRP06	17	-0.0000	57.1040	13.8498	-47.8261	173.9130	-29.3602 to 29.3602
GRP07	17	-0.0000	69.2124	16.7865	-60.6178	142.8570	-35.5858 to 35.5857
GRP08	17	0.0000	21.5583	5.2286	-36.8421	36.8421	-11.0842 to 11.0842
GRP09	17	0.0000	28.5947	6.9352	-45.0538	46.5231	-14.7020 to 14.7021
GRP10	17	-0.0000	12.8455	3.1155	-38.7388	15.9588	-6.6046 to 6.6045
Total	170	-0.0003	53.4205	4.0972	-79.1413	456.2315	-8.0885 to 8.0879

TABLE 4.4

ONEWAY

Variable: PERS1CL % diff. SILT 1/CLAY ratio
by Variable SOIL

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.
Between groups	9	0.0449	0.0050	0.000	1.0000
Within groups	120	963686.5888	8030.7216		
Total	129	963686.6300			

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean
GRP01	13	0.0000	21.3545	5.9227	-38.5957	34.3219	-12.9043 to 12.9044
GRP02	13	-0.0011	53.0873	14.7238	-34.5761	173.0189	-32.0814 to 32.0792
GRP03	13	-0.0052	134.8185	37.3919	-96.5780	315.5240	-81.4752 to 81.4648
GRP04	13	-0.0626	128.2785	35.5781	-87.3690	406.2945	-77.5806 to 77.4553
GRP05	13	-0.0025	20.7390	5.7520	-30.0547	49.2166	-12.5349 to 12.5299
GRP06	13	-0.0052	114.7365	31.8222	-72.7134	340.3496	-69.3397 to 69.3294
GRP07	13	-0.0027	90.7896	25.1805	-76.5093	169.8934	-54.8663 to 54.8609
GRP08	13	0.0014	81.7202	22.6651	-84.3621	175.2262	-49.3816 to 49.3844
GRP09	13	0.0004	103.1963	28.6215	-92.9189	276.5196	-62.3604 to 62.3613
GRP10	13	0.0032	56.8909	15.7787	-41.0728	185.4859	-34.3756 to 34.3820
Total	130	-0.0074	86.4317	7.5806	-96.5780	406.2945	-15.0057 to 14.9909

ONEWAY

Variable: PERS2CL % diff. SILT 2/CLAY ratio
by Variable SOIL

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.
Between groups	9	0.0259	0.0029	0.000	1.0000
Within groups	160	1879487.1406	11746.7950		
Total	169	1879487.2000			

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean
GRP01	17	0.0021	22.3028	5.4092	-41.7306	33.5340	-11.4649 to 11.4691
GRP02	17	-0.0002	15.6973	3.8072	-31.0725	21.1769	-8.0710 to 8.0706
GRP03	17	-0.0246	90.4643	21.9408	-74.3409	281.6794	-46.5370 to 46.4879
GRP04	17	-0.0185	159.7038	38.7339	-83.8653	605.6229	-82.1306 to 82.0937
GRP05	17	0.0101	28.4705	6.9051	-74.9241	47.5618	-14.6281 to 14.6483
GRP06	17	0.0046	114.3158	27.7257	-65.5309	405.4476	-58.7712 to 58.7804
GRP07	17	0.0213	98.7891	23.9599	-70.9640	231.3892	-50.7714 to 50.8139
GRP08	17	-0.0003	215.5261	52.2728	-91.6688	829.1551	-110.8136 to 110.8130
GRP09	17	-0.0000	103.8894	25.1969	-91.2275	346.5350	-53.4150 to 53.4150
GRP10	17	-0.0006	46.3954	11.2525	-59.9977	159.6067	-23.8550 to 23.8537
Total	170	-0.0006	105.4572	8.0882	-91.6688	829.1551	-15.9675 to 15.9663

TABLE 4.5

ONEWAY

Variable: SAND1
by Variable SOIL

PERC.DIFF. SAND1

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.
Between groups	9	1.6615	0.1846	0.000	1.0000
Within groups	120	155796.3060	1298.3026		
Total	129	155797.9700			

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean
GRP01	13	0.3077	2.8689	0.7957	-6.0000	4.0000	-1.4260 to 2.0414
GRP02	13	-0.0769	3.9043	1.0829	-5.0000	9.0000	-2.4363 to 2.2824
GRP03	13	-0.0769	2.1394	0.5934	-3.0000	6.0000	-1.3697 to 1.2159
GRP04	13	0.0769	4.2123	1.1683	-5.0000	11.0000	-2.4686 to 2.6224
GRP05	13	-0.0769	3.9888	1.1063	-4.0000	10.0000	-2.4873 to 2.3335
GRP06	13	-0.0769	52.6347	14.5982	-32.0000	157.0000	-31.8837 to 31.7299
GRP07	13	0.0000	75.0189	20.8065	-40.0000	202.0000	-45.3335 to 45.3335
GRP08	13	0.0000	52.2414	14.4892	-47.0000	147.0000	-31.5692 to 31.5692
GRP09	13	0.0769	41.7721	11.5855	-64.0000	70.0000	-25.1657 to 25.3196
GRP10	13	0.0000	7.0000	1.9415	-16.0000	14.0000	-4.2301 to 4.2301
Total	130	0.0154	34.7525	3.0480	-64.0000	202.0000	-6.0151 to 6.0459

ONEWAY

Variable: SAND2
by Variable SOIL

PERC.DIFF. SAND2.

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.
Between groups	9	1.6235	0.1804	0.000	1.0000
Within groups	160	267396.3539	1671.2272		
Total	169	267397.9800			

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean
GRP01	17	0.0588	3.5789	0.8680	-7.0000	4.0000	-1.7813 to 1.8989
GRP02	17	0.0000	5.5114	1.3367	-9.0000	15.0000	-2.8337 to 2.8337
GRP03	17	-0.0588	2.0147	0.4886	-4.0000	4.0000	-1.0947 to 0.9770
GRP04	17	0.1176	2.7587	0.6691	-4.0000	6.0000	-1.3007 to 1.5360
GRP05	17	0.0000	3.5532	0.8618	-7.0000	7.0000	-1.8269 to 1.8269
GRP06	17	-0.1176	44.8635	10.8810	-35.0000	140.0000	-23.1843 to 22.9490
GRP07	17	0.2353	73.9168	17.9275	-52.0000	202.0000	-37.7692 to 38.2398
GRP08	17	0.0000	53.7901	13.0460	-56.0000	135.0000	-27.6563 to 27.6563
GRP09	17	-0.0588	77.9884	18.9150	-63.0000	190.0000	-40.1567 to 40.0391
GRP10	17	-0.0588	13.8856	3.3677	-27.0000	30.0000	-7.1981 to 7.0805
Total	170	0.0118	39.7773	3.0508	-63.0000	202.0000	-6.0108 to 6.0343

TABLE 5. Analysis of variance of the proportional (%) DEVIATION from the mean of each soil per LABORATORY.

These tables give information on the performance of each laboratory on all soils (upper print-out). The column "mean" gives the mean % deviation by averaging the % deviations from the mean of each soil.
Thus, the difference in weight of the soil values is eliminated.

To eliminate the influence of the "difficult" andosol, the analysis of variance was also executed without the values of samples 8 and 9 (bottom print-out).

TABLE 5.1

Variable: CEC
by Variable LAB

PERC. DIFF. CEC.

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	19	69040.0799	3633.6884	6.546	0.0000	VERY SIGN.
Within groups	180	99913.2001	555.0733			
Total	199	168953.2800				

Group	Count	(%) Mean	(%) 95% conf int	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP01	10	-14.3	± 8.6	12.0743	3.8182	-40.0000	-2.0000	-22.9374	to	-5.6626
GRP02	10	-44.2	13.1	18.2562	5.7731	-74.0000	-12.0000	-57.2597	to	-31.1403
GRP03	10	-7.3	12.2	17.0753	5.3997	-42.0000	21.0000	-19.5149	to	4.9149
GRP04	10	1.6	10.2	14.2142	4.4949	-18.0000	20.0000	-8.5682	to	11.7682
GRP05	10	2.0	8.8	12.3378	3.9016	-16.0000	33.0000	-6.8260	to	10.8260
GRP06	10	-7.9	9.5	13.2619	4.1938	-25.0000	20.0000	-17.3870	to	1.5870
GRP07	10	-29.0	15.7	21.2184	6.7099	-57.0000	8.0000	-44.1788	to	-13.8212
GRP08	10	-12.2	12.2	9.1990	2.9090	-27.0000	5.0000	-18.7806	to	-5.6194
GRP09	10	-17.2	46.0	64.1869	20.2977	-77.0000	153.0000	-63.1165	to	28.7165
GRP10	10	10.3	6.7	9.3339	2.9516	-8.0000	20.0000	3.6229	to	16.9771
GRP11	10	1.0	7.0	9.8319	3.1091	-11.0000	23.0000	-6.0333	to	8.0333
GRP12	10	27.2	16.8	23.3942	7.3979	7.0000	63.0000	10.4648	to	43.9352
GRP13	10	29.4	12.3	17.2640	5.4593	-3.0000	48.0000	17.0501	to	41.7499
GRP14	10	21.5	13.4	18.7750	5.9372	-17.0000	44.0000	8.0692	to	34.9308
GRP15	10	-12.1	30.9	43.1778	13.6540	-50.0000	93.0000	-42.9875	to	18.7875
GRP16	10	0.6	10.1	14.0570	4.4452	-23.0000	16.0000	-9.4558	to	10.6558
GRP17	10	4.5	9.3	12.9636	4.0995	-14.0000	31.0000	-4.7736	to	13.7736
GRP18	10	24.6	22.5	31.5038	9.9624	-32.0000	78.0000	2.0636	to	47.1364
GRP19	10	0.5	10.1	14.0811	4.4528	-11.0000	36.0000	-9.5730	to	10.5730
GRP20	10	19.8	13.3	18.5341	5.8610	-7.0000	53.0000	6.5415	to	33.0585
Total	200	±14.4	±14.4	29.1378	2.0604	-77.0000	153.0000	-4.1229	to	4.0029

Variable: CEC
by Variable LAB

CEC, PERC. DIFF.WITHOUT ANDO.

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	19	49887.4000	2625.6526	4.729	0.0000	VERY SIGN.
Within groups	140	77727.0001	555.1929			
Total	159	127614.4000				

Group	Count	(%) Mean	(%) 95% conf int	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP01	8	-12.2	±10.3	12.3027	4.3497	-40.0000	-2.0000	-22.5353	to	-1.9647
GRP02	8	-37.6	11.2	13.3410	4.7168	-53.0000	-12.0000	-48.7783	to	-26.4717
GRP03	8	-7.2	16.2	19.3446	6.8394	-42.0000	21.0000	-23.4225	to	8.9225
GRP04	8	5.8	10.4	12.3917	4.3811	-13.0000	20.0000	-4.4847	to	16.2347
GRP05	8	-1.7	5.4	6.4973	2.2971	-16.0000	4.0000	-7.1818	to	3.6818
GRP06	8	-11.1	8.5	10.1198	3.5779	-25.0000	5.0000	-19.5854	to	-2.6646
GRP07	8	-36.5	13.0	15.6022	5.5162	-57.0000	-16.0000	-49.5437	to	-23.4563
GRP08	8	-14.3	6.5	7.8182	2.7642	-27.0000	-3.0000	-20.9112	to	-7.8388
GRP09	8	-5.6	55.9	66.9284	23.6628	-50.0000	153.0000	-61.5784	to	50.3284
GRP10	8	9.7	8.5	10.2225	3.6142	-8.0000	20.0000	1.2038	to	18.2962
GRP11	8	-2.1	5.5	6.5343	2.3102	-11.0000	6.0000	-7.5878	to	3.3378
GRP12	8	24.8	19.6	23.7513	8.3974	7.0000	63.0000	5.0184	to	44.7316
GRP13	8	26.6	15.3	18.3687	6.4943	-3.0000	48.0000	11.2684	to	41.9816
GRP14	8	22.7	16.4	19.6014	6.9301	-17.0000	44.0000	6.3629	to	39.1371
GRP15	8	-7.8	39.7	47.5438	16.8093	-50.0000	93.0000	-47.6225	to	31.8725
GRP16	8	1.3	11.0	13.1468	4.6481	-23.0000	16.0000	-9.6160	to	12.3660
GRP17	8	4.2	12.3	14.6848	5.1919	-14.0000	31.0000	-8.0268	to	16.5268
GRP18	8	17.6	23.8	28.5003	10.0764	-32.0000	58.0000	-6.2018	to	41.4518
GRP19	8	-2.8	6.0	7.1801	2.5385	-11.0000	8.0000	-8.8777	to	3.1277
GRP20	8	23.2	16.1	19.3003	6.8237	-7.0000	53.0000	7.1146	to	39.3854
Total	160	±13.7	±15.6	28.3303	2.2397	-57.0000	153.0000	-4.5734	to	4.2734

TABLE 5.2

Variable: CLAY
by Variable LAB

PERC. DIFF. CLAY

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	19	100087.0552	5267.7397	5.448	0.0000	VERY SIGN.
Within groups	180	174053.7005	966.9650			
Total	199	274140.7500				

Group	Count	(%) Mean	95% conf int	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP01	10	-36.8	±16.6	23.2799	7.3618	-79.0000	-4.0000	-53.4535	to	-20.1465
GRP02	10	1.5	15.3	21.3398	6.7483	-38.0000	44.0000	-13.7656	to	16.7656
GRP03	10	16.3	14.1	19.7431	6.2433	-14.0000	48.0000	2.1767	to	30.4233
GRP04	10	12.7	20.3	28.4451	8.9951	-14.0000	91.0000	-7.6484	to	33.0484
GRP05	10	40.4	30.2	42.1721	13.3360	2.0000	122.0000	10.2319	to	70.5681
GRP06	10	-4.5	13.7	19.1384	6.0521	-57.0000	9.0000	-18.1908	to	9.1908
GRP07	10	10.2	10.5	14.6652	4.6375	-20.0000	39.0000	-0.2908	to	20.6908
GRP08	10	-6.6	21.4	29.9600	9.4742	-88.0000	13.0000	-28.0321	to	14.8321
GRP09	10	-13.9	17.8	24.8214	7.8492	-68.0000	6.0000	-31.6561	to	3.8561
GRP10	10	-17.4	8.0	11.1972	3.5409	-41.0000	-6.0000	-25.4100	to	-9.3900
GRP11	10	-5.3	14.5	20.3309	6.4292	-57.0000	13.0000	-19.8438	to	9.2438
GRP12	10	59.4	65.1	91.0777	28.8013	6.0000	264.0000	-5.7531	to	124.5531
GRP13	10	-30.0	21.5	30.0814	9.5126	-81.0000	0.0000	-51.5189	to	-8.4811
GRP14	10	8.9	18.0	25.1504	7.9533	-34.0000	50.0000	-9.0915	to	26.8915
GRP15	10	-31.6	13.8	19.3287	6.1123	-69.0000	-7.0000	-45.4269	to	-17.7731
GRP16	10	11.0	8.9	12.4989	3.9525	-2.0000	34.0000	2.0588	to	19.9412
GRP17	10	8.7	14.5	20.2487	6.4032	-8.0000	60.0000	-5.7851	to	23.1851
GRP18	10	-9.3	24.4	34.2411	10.8280	-95.0000	18.0000	-33.7946	to	15.1946
GRP19	10	-10.2	15.2	21.2592	6.7228	-63.0000	10.0000	-25.4079	to	5.0079
GRP20	10	-2.8	13.1	18.2745	5.7789	-44.0000	16.0000	-15.8727	to	10.2727
Total	200	±16.9	±18.8	37.1159	2.6245	-95.0000	264.0000	-5.1404	to	5.2104

Variable: CLAY
by Variable LAB

CLAY PERC. DIFF.WITHOUT ANDO.

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	19	27862.0250	1466.4224	10.218	0.0000	VERY SIGN.
Within groups	140	20091.7500	143.5125			
Total	159	47953.7750				

Group	Count	(%) Mean	95% conf int	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP01	8	-31.3	±16.9	20.2127	7.1463	-54.0000	-4.0000	-48.2732	to	-14.4768
GRP02	8	1.1	8.5	10.2182	3.6127	-11.0000	15.0000	-7.4176	to	9.6676
GRP03	8	16.1	12.6	15.0470	5.3199	-7.0000	41.0000	3.5455	to	28.7045
GRP04	8	6.2	3.2	3.8822	1.3726	1.0000	12.0000	3.0044	to	9.4956
GRP05	8	21.6	13.5	16.1328	5.7038	2.0000	53.0000	8.1377	to	35.1123
GRP06	8	0.6	4.4	5.3168	1.8798	-9.0000	9.0000	-3.8199	to	5.0699
GRP07	8	10.3	3.5	5.2627	1.8607	4.0000	20.0000	5.9752	to	14.7748
GRP08	8	4.5	6.4	7.6718	2.7124	-12.0000	13.0000	-1.9138	to	10.9138
GRP09	8	-2.5	3.6	5.3719	1.8992	-9.0000	6.0000	-6.9910	to	1.9910
GRP10	8	-14.8	7.1	8.5262	3.0145	-34.0000	-6.0000	-22.0031	to	-7.7469
GRP11	8	2.2	7.2	8.5815	3.0340	-9.0000	13.0000	-4.9243	to	9.4243
GRP12	8	17.0	5.4	6.5027	2.2991	6.0000	26.0000	11.5636	to	22.4364
GRP13	8	-20.2	20.1	24.0639	8.5079	-58.0000	0.0000	-40.3679	to	-0.1321
GRP14	8	-0.3	14.9	17.8080	6.2961	-34.0000	19.0000	-15.2628	to	14.5128
GRP15	8	-23.7	9.1	10.8595	3.8394	-40.0000	-7.0000	-32.8287	to	-14.6713
GRP16	8	5.7	5.4	6.4973	2.2971	-2.0000	19.0000	0.3182	to	11.1818
GRP17	8	3.8	8.4	10.0774	3.5629	-8.0000	18.0000	-4.5499	to	12.2999
GRP18	8	5.0	8.6	10.3372	3.6547	-7.0000	18.0000	-3.6421	to	13.6421
GRP19	8	-4.3	9.8	11.7709	4.1616	-18.0000	10.0000	-14.2157	to	5.4657
GRP20	8	3.7	9.2	10.9512	3.8718	-18.0000	16.0000	-5.4054	to	12.9054
Total	160	±9.7	± 8.9	17.3665	1.3729	-58.0000	53.0000	-2.6741	to	2.7491

TABLE 5.3

PERC. DIFF. CEC/CLAY.

Variable: CECCLAY
by Variable LAB

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	19	271424.5381	14285.5020	2.526	0.0008	VERY SIGN.
Within groups	180	1018009.4171	5655.6078			
Total	199	1289434.0000				

Group	Count	Mean (%)	95% conf int	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP01	10	28.4	±32.7	45.6861	14.4472	-39.7644	88.1822	-4.2432	to	61.1205
GRP02	10	-47.6	18.1	25.3590	8.0192	-92.5842	-2.2587	-65.8153	to	-29.5338
GRP03	10	-29.7	16.8	23.5359	7.4427	-67.8645	-0.1272	-46.5615	to	-12.8885
GRP04	10	-16.4	21.7	30.3654	9.6024	-75.9651	17.2358	-38.1726	to	5.2716
GRP05	10	-31.3	19.0	26.6250	8.4196	-76.1728	0.7194	-50.4032	to	-12.3104
GRP06	10	-16.1	13.3	18.6456	5.8962	-53.6333	9.7890	-29.5047	to	-2.8283
GRP07	10	-46.4	9.5	13.3358	4.2171	-67.8797	-30.7087	-55.9921	to	-36.9125
GRP08	10	5.6	67.8	94.8331	29.9889	-49.2599	273.8761	-62.1630	to	73.5160
GRP09	10	-19.2	38.0	53.0952	16.7902	-70.2639	119.4376	-57.2014	to	18.7625
GRP10	10	15.4	21.9	30.6080	9.6791	-34.3046	74.9271	-6.4347	to	37.3565
GRP11	10	-7.1	13.3	18.5778	5.8748	-40.4839	26.3167	-20.4085	to	6.1710
GRP12	10	-13.3	29.5	41.2938	13.0582	-83.5157	47.4820	-42.8608	to	16.2188
GRP13	10	87.1	65.0	90.8525	28.7301	5.6736	306.5161	22.1625	to	152.1464
GRP14	10	6.2	34.0	47.4731	15.0123	-71.7412	92.6509	-27.7408	to	40.1795
GRP15	10	11.3	38.7	54.1200	17.1142	-29.2435	150.1821	-27.3186	to	50.1115
GRP16	10	-18.9	19.5	27.2420	8.6147	-74.9005	12.3360	-38.4475	to	0.5280
GRP17	10	-14.1	22.2	31.0613	9.8225	-65.3126	32.4802	-36.3370	to	8.1028
GRP18	10	101.3	198.0	276.7688	87.5220	-46.8163	884.3787	-96.6627	to	299.3140
GRP19	10	-1.7	16.9	23.5561	7.4491	-41.7418	30.0555	-18.6106	to	15.0913
GRP20	10	6.4	17.1	23.9222	7.5649	-47.7972	34.2926	-10.6139	to	23.6119
Total	200	±21.2	±35.7	80.4958	5.6919	-92.5842	884.3787	-11.2317	to	11.2167

PERC. DIFF. CEC/CLAY, WITHOUT ANDO

Variable: CECCLAY
by Variable LAB

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	19	100615.8736	5295.5723	6.088	0.0000	VERY SIGN.
Within groups	140	121786.4548	869.9033			
Total	159	222402.3300				

Group	Count	Mean (%)	95% conf int	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP01	8	32.7	±35.8	42.8576	15.1525	-37.7823	88.1822	-3.0598	to	68.5998
GRP02	8	-39.0	16.1	19.2441	6.8038	-62.7863	-2.2587	-55.1322	to	-22.9553
GRP03	8	-21.8	15.5	18.5402	6.5550	-56.8067	-0.1272	-37.3301	to	-6.3301
GRP04	8	-3.5	12.2	14.5631	5.1488	-23.3596	17.2358	-15.6900	to	8.6601
GRP05	8	-20.4	12.8	15.3271	5.4189	-49.5847	0.7194	-33.2937	to	-7.6663
GRP06	8	-14.7	10.2	12.1591	4.2989	-31.3711	4.3291	-24.8928	to	-4.5624
GRP07	8	-44.8	10.2	12.2518	4.3317	-62.0991	-30.7087	-55.0566	to	-34.5711
GRP08	8	-20.9	5.5	6.6077	2.3362	-31.1953	-10.1909	-26.5056	to	-15.4572
GRP09	8	-9.4	46.1	55.0956	19.4792	-50.6997	119.4376	-55.4786	to	36.6433
GRP10	8	25.8	20.0	23.9273	8.4596	-2.3622	74.9271	5.8060	to	45.8134
GRP11	8	-7.1	9.3	11.1807	3.9530	-21.2828	9.0347	-16.4749	to	2.2197
GRP12	8	3.4	20.0	24.0441	8.5009	-17.2012	47.4820	-16.6284	to	23.5743
GRP13	8	66.4	44.5	53.2411	18.8236	5.6736	166.5394	21.9582	to	110.9793
GRP14	8	23.1	29.3	34.9999	12.3743	-28.0198	92.6509	-6.0831	to	52.4381
GRP15	8	16.4	50.0	59.8531	21.1613	-29.2435	150.1821	-33.5907	to	66.4860
GRP16	8	-7.5	11.3	13.5861	4.8034	-33.5568	12.3360	-18.9518	to	3.7647
GRP17	8	-2.0	16.9	20.2145	7.1469	-31.5168	32.4802	-18.9702	to	14.8291
GRP18	8	9.6	25.6	30.6254	10.8277	-46.8163	51.0791	-15.9100	to	35.2968
GRP19	8	-0.7	15.4	18.4193	6.5122	-22.3097	22.6136	-16.1376	to	14.6601
GRP20	8	14.3	12.8	15.3308	5.4203	-8.3969	34.2926	1.5008	to	27.1344
Total	160	±28.6	±21.0	37.4000	2.9567	-62.7863	166.5394	-5.8486	to	5.8304

TABLE 5.4

ONEWAY

Variable: PERSI1
by Variable LAB

% diff. SILT 1

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	12	106656.1920	8888.0160	4.346	0.0000	VERY SIGN.
Within groups	117	239265.8338	2045.0071			
Total	129	345922.0300				

Group	Count	Mean (%)	95% conf int	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP01	10	58.2	±69.9	97.7369	30.9071	-25.5208	283.2608	-11.6736	to	128.1599
GRP02	10	-24.8	12.1	16.8639	5.3328	-53.7560	-6.1855	-36.9445	to	-12.8171
GRP05	10	-25.2	19.7	27.5137	8.7006	-67.5000	12.8472	-44.8855	to	-5.5214
GRP06	10	7.9	8.6	11.9659	3.7840	-8.5937	29.4800	-0.5735	to	16.5463
GRP07	10	-18.3	23.8	33.2996	10.5303	-64.0325	17.3611	-42.2064	to	5.4358
GRP08	10	-20.6	28.3	39.5298	12.5004	-94.8618	29.4820	-48.9005	to	7.6554
GRP10	10	36.3	53.3	74.5395	23.5714	-11.9792	233.9842	-16.9397	to	89.7049
GRP11	10	-16.6	20.1	28.0807	8.8799	-79.4471	21.7131	-36.7601	to	3.4153
GRP12	10	-27.7	15.0	20.9528	6.6259	-59.3750	4.6983	-42.6995	to	-12.7221
GRP13	10	48.3	39.1	54.6484	17.2813	-6.7744	164.0626	9.2574	to	87.4436
GRP14	10	9.0	28.4	39.7243	12.5619	-22.9267	111.2499	-19.3271	to	37.5070
GRP18	10	-18.2	26.0	36.3139	11.4835	-94.8207	15.1041	-44.2051	to	7.7496
GRP19	10	-8.3	16.2	22.5764	7.1393	-33.2032	30.8729	-24.5043	to	7.7961
Total	130	±24.6	±27.7	51.7838	4.5417	-94.8618	283.2608	-8.9863	to	8.9856

ONEWAY

Variable: PERSI1
by Variable LAB

% diff. SILT 1 (without ANDO)

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	12	120756.1759	10063.0150	4.619	0.0000	VERY SIGN.
Within groups	91	198263.3785	2178.7184			
Total	103	319019.5500				

Group	Count	Mean (%)	95% conf int	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP01	8	78.4	±83.3	99.7198	35.2563	-6.1855	283.2608	-4.9084	to	161.8268
GRP02	8	-26.4	15.4	18.4123	6.5097	-53.7560	-6.1855	-41.8099	to	-11.0239
GRP05	8	-32.9	20.8	24.8782	8.7958	-67.5000	2.7492	-53.7097	to	-12.1123
GRP06	8	5.6	9.8	11.7771	4.1638	-8.5937	29.4800	-4.2246	to	15.4672
GRP07	8	-27.2	26.2	31.3014	11.0667	-64.0325	3.7815	-53.3870	to	-1.0499
GRP08	8	-25.7	33.5	40.1024	14.1783	-94.8618	7.2166	-59.2355	to	7.8173
GRP10	8	46.5	67.6	80.8591	28.5880	-6.1855	233.9842	-21.0723	to	114.1272
GRP11	8	-22.6	22.9	27.4002	9.6874	-79.4471	-1.6807	-45.5286	to	0.2856
GRP12	8	-25.3	19.3	23.0549	8.1511	-59.3750	4.6983	-44.6226	to	-6.0740
GRP13	8	44.1	51.1	61.1366	21.6151	-6.7744	164.0626	-6.9850	to	95.2378
GRP14	8	11.2	37.3	44.6450	15.7844	-22.9267	111.2499	-26.0825	to	48.5656
GRP18	8	-12.8	21.5	25.7927	9.1191	-48.2080	14.7058	-34.3833	to	8.7431
GRP19	8	-12.9	18.3	21.8650	7.7304	-33.2032	30.8729	-31.2158	to	5.3433
Total	104	±28.6	±32.8	55.6532	5.4572	-94.8618	283.2608	-10.8236	to	10.8227

TABLE 5.5

ONEWAY

Variable: PERSI2 % diff. SILT 2
by Variable LAB

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	16	119840.9043	7490.0565	3.162	0.0001	VERY SIGN.
Within groups	153	362442.0504	2368.9023			
Total	169	482282.9500				

Group	Count	(%) Mean	95% conf int	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP03	10	-36.1	±11.4	15.8815	5.0222	-68.5186	-15.0000	-47.5005	to	-24.7787
GRP04	10	-3.0	19.1	26.7509	8.4594	-65.2355	24.5614	-22.1368	to	16.1361
GRP05	10	-28.3	14.8	20.7267	6.5544	-60.7397	-6.7580	-43.2151	to	-13.5612
GRP06	10	7.5	6.2	8.6205	2.7260	-4.3478	24.8776	1.3634	to	13.6968
GRP07	10	-16.9	23.7	33.0577	10.4538	-68.7120	29.8727	-40.6013	to	6.6948
GRP09	10	-19.3	17.5	24.4243	7.7237	-47.4904	39.0579	-36.8005	to	-1.8563
GRP10	10	26.9	39.4	55.0237	17.4000	-12.2807	174.8223	-12.4462	to	66.2769
GRP11	10	-14.7	16.1	22.5377	7.1270	-68.5917	7.0175	-30.8937	to	1.3512
GRP12	10	-17.8	18.3	25.5008	8.0641	-47.4904	25.9258	-36.0888	to	0.3956
GRP13	10	44.9	43.8	61.2171	19.3586	-9.6124	173.9130	1.1313	to	88.7154
GRP14	10	12.8	35.8	50.0568	15.8294	-30.4711	142.8570	-22.9927	to	48.6243
GRP15	10	71.6	103.2	144.2110	45.6035	-45.0538	456.2315	-31.5390	to	174.7854
GRP16	10	-8.1	17.1	23.8741	7.5497	-51.3297	31.2741	-25.2677	to	8.8894
GRP17	10	-15.1	23.6	32.9902	10.4324	-65.2355	17.5439	-38.7869	to	8.4126
GRP18	10	0.4	15.4	21.4874	6.7949	-34.7826	28.0702	-14.9127	to	15.8296
GRP19	10	9.2	34.6	48.3564	15.2916	-44.3768	131.6360	-25.3330	to	43.8512
GRP20	10	-13.7	26.9	37.6298	11.8996	-79.1413	38.1979	-40.6450	to	13.1924
Total	170	±20.3	±27.4	53.4205	4.0972	-79.1413	456.2315	-8.0885	to	8.0879

ONEWAY

Variable: PERSI2 % diff. SILT 2 (without ANDO)
by Variable LAB

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	16	145146.7886	9071.6743	3.410	0.0001	VERY SIGN.
Within groups	119	316617.5177	2660.6514			
Total	135	461764.3000				

Group	Count	(%) Mean	95% conf int	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP03	8	-36.4	±14.9	17.7846	6.2878	-68.5186	-15.0000	-51.3073	to	-21.5708
GRP04	8	-6.1	23.6	28.2727	9.9959	-65.2355	17.7810	-29.8205	to	17.4525
GRP05	8	-32.8	17.4	20.8074	7.3565	-60.7397	-8.1081	-50.2815	to	-15.4906
GRP06	8	5.2	5.7	6.7943	2.4022	-4.3478	17.7810	-0.4737	to	10.8867
GRP07	8	-24.9	26.1	31.2747	11.0573	-68.7120	4.0153	-51.0719	to	1.2206
GRP09	8	-16.2	22.3	26.6870	9.4353	-47.4904	39.0579	-38.5684	to	6.0532
GRP10	8	36.0	48.9	58.4496	20.6650	-1.5444	174.8223	-12.8409	to	84.8890
GRP11	8	-18.0	19.9	23.8664	8.4380	-68.5917	2.3147	-38.0330	to	1.8725
GRP12	8	-12.2	21.4	25.6109	9.0548	-47.4904	25.9258	-33.6906	to	9.1319
GRP13	8	45.7	57.9	69.3384	24.5148	-9.6124	173.9130	-12.2347	to	103.7018
GRP14	8	17.5	46.5	55.6250	19.6664	-30.4711	142.8570	-28.9700	to	64.0372
GRP15	8	96.6	127.0	151.8875	53.7003	0.6435	456.2315	-30.2850	to	223.6767
GRP16	8	-10.5	21.6	25.8943	9.1550	-51.3297	31.2741	-32.2327	to	11.0635
GRP17	8	-21.5	28.4	33.9275	11.9952	-65.2355	15.9588	-49.9449	to	6.7831
GRP18	8	-4.7	17.2	20.5768	7.2750	-34.7826	13.7668	-21.9992	to	12.4060
GRP19	8	7.3	45.5	54.3968	19.2322	-44.3768	131.6360	-38.0979	to	52.8556
GRP20	8	-24.5	28.1	33.5913	11.8763	-79.1413	7.2072	-52.6472	to	3.5187
Total	136	±23.9	±33.7	58.4848	5.0150	-79.1413	456.2315	-9.9186	to	9.9178

TABLE 5.6

ONEWAY

Variable: PERS1CL
by Variable LAB

% diff. SILT 1/CLAY ratio

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	12	412541.0006	34378.4170	7.298	0.0000	VERY SIGN.
Within groups	117	551145.6358	4710.6465			
Total	129	963686.6300				

Group	Count	(%) Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP01	10	129.2	148.5960	46.9902	-48.9378	406.2945	22.9229	to	235.5211
GRP02	10	-37.5	24.5551	7.7650	-69.2023	-2.1369	-55.1300	to	-19.9987
GRP05	10	-55.9	18.4695	5.8406	-78.5092	-30.0547	-69.2034	to	-42.7788
GRP06	10	-7.4	18.0810	5.7177	-38.6051	14.0303	-20.3552	to	5.5135
GRP07	10	-40.0	27.6908	8.7566	-76.0463	-4.2956	-59.8646	to	-20.2471
GRP08	10	-14.0	64.3508	20.3495	-96.5780	139.8378	-60.1080	to	31.9596
GRP10	10	37.8	90.1646	28.5126	-56.8955	278.1268	-26.6908	to	102.3090
GRP11	10	-25.5	30.1992	9.5498	-86.3122	3.6198	-47.1632	to	-3.9567
GRP12	10	-52.1	28.3345	8.9601	-92.9189	-3.7312	-72.4604	to	-31.9219
GRP13	10	111.5	128.4090	40.6065	-17.8982	340.3496	19.7305	to	203.4469
GRP14	10	-7.2	68.0523	21.5200	-71.7442	169.4524	-55.9659	to	41.3975
GRP18	10	-26.2	24.6176	7.7848	-62.2185	12.8304	-43.8339	to	-8.6131
GRP19	10	-12.3	37.5276	11.8673	-49.5831	49.2166	-39.1966	to	14.4946
Total	130	±42.8	86.4317	7.5806	-96.5780	406.2945	-15.0057	to	14.9909

ONEWAY

Variable: PERS1CL
by Variable LAB

% diff. SILT 1/CLAY ratio (without ANDO)

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	12	333684.6407	27807.0530	5.995	0.0000	VERY SIGN.
Within groups	91	422070.1463	4638.1335			
Total	103	755754.7900				

Group	Count	(%) Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP01	8	146.8	152.6482	53.9693	-6.7413	406.2945	19.1997	to	274.4333
GRP02	8	-33.7	26.2290	9.2733	-69.2023	-2.1369	-55.6815	to	-11.8256
GRP05	8	-51.8	18.1929	6.4322	-76.5093	-30.0547	-67.0750	to	-36.6557
GRP06	8	-8.1	19.2368	6.8012	-38.6051	14.0303	-24.2187	to	7.9461
GRP07	8	-40.2	31.3887	11.0976	-76.0463	-4.2956	-66.4911	to	-14.0080
GRP08	8	-36.0	36.3801	12.8623	-96.5780	6.5814	-66.4257	to	-5.5967
GRP10	8	51.2	94.5625	33.4329	-6.7413	278.1268	-27.8205	to	130.2915
GRP11	8	-30.9	31.6412	11.1869	-86.3122	3.6198	-57.3637	to	-4.4585
GRP12	8	-43.0	23.5055	8.3105	-72.3723	-3.7312	-62.7299	to	-23.4277
GRP13	8	83.0	125.7080	44.4445	-17.8982	340.3496	-22.0766	to	188.1119
GRP14	8	6.0	70.0067	24.7511	-51.5222	169.4524	-52.4613	to	64.5927
GRP18	8	-26.2	27.7827	9.8227	-62.2185	12.8304	-49.4714	to	-3.0177
GRP19	8	-17.0	36.4066	12.8717	-49.5831	49.2166	-47.4450	to	13.4282
Total	104	±44.1	85.6588	8.3995	-96.5780	406.2945	-16.6680	to	16.6490

TABLE 5.7

ONEWAY

Variable: PERS2CL
by Variable LAB

% diff. SILT 2/CLAY ratio

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	16	454770.9191	28423.1820	3.052	0.0002	VERY SIGN.
Within groups	153	1424716.2494	9311.8710			
Total	169	1879487.2000				

Group	Count	(%) Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP03	10	-53.2	19.4632	6.1548	-77.1658	-22.1062	-67.1775	to	-39.3313
GRP04	10	-25.5	31.4130	9.9337	-72.0097	8.9503	-47.9858	to	-3.0428
GRP05	10	-55.0	20.0069	6.3268	-84.0082	-29.4742	-69.3314	to	-40.7071
GRP06	10	-2.1	32.0750	10.1430	-60.5427	63.1013	-25.1251	to	20.7649
GRP07	10	-36.2	32.0124	10.1232	-75.1929	-2.8843	-59.1766	to	-13.3761
GRP09	10	-20.2	23.6912	7.4918	-54.1537	29.7101	-37.2166	to	-3.3214
GRP10	10	34.5	91.1177	28.8140	-42.1448	281.6794	-30.5889	to	99.7744
GRP11	10	-22.3	30.9288	9.7805	-74.3409	17.4329	-44.4923	to	-0.2422
GRP12	10	-41.7	35.1755	11.1235	-91.6688	16.4814	-66.9589	to	-16.6328
GRP13	10	113.7	151.1200	47.7883	-20.3724	405.4476	5.6539	to	221.8633
GRP14	10	1.6	83.5346	26.4160	-75.9074	215.9801	-58.0943	to	61.4198
GRP15	10	113.5	187.0229	59.1418	-20.4490	605.6229	-20.2521	to	247.3241
GRP16	10	-29.6	28.4138	8.9852	-73.5254	14.6158	-50.0150	to	-9.3629
GRP17	10	-34.6	33.6148	10.6299	-69.3740	18.9149	-58.6879	to	-10.5949
GRP18	10	72.2	267.0749	84.4565	-55.2565	829.1551	-118.8240	to	263.2836
GRP19	10	9.1	60.5345	19.1427	-56.8657	114.4675	-34.1806	to	52.4270
GRP20	10	-23.9	41.2446	13.0427	-83.8653	40.3879	-53.4111	to	5.5980
Total	170	±40.5	105.4572	8.0882	-91.6688	829.1551	-15.9675	to	15.9663

ONEWAY

Variable: PERS2CL
by Variable LAB

% diff. SILT 2/CLAY ratio (without ANDO)

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	16	350249.2002	21890.5750	4.247	0.0000	VERY SIGN.
Within groups	119	613325.6979	5153.9974			
Total	135	963574.9000				

Group	Count	(%) Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP03	8	-48.3	18.6175	6.5823	-74.9241	-22.1062	-63.9645	to	-32.8353
GRP04	8	-17.4	28.9704	10.2426	-70.2017	8.9503	-41.6715	to	6.7680
GRP05	8	-48.7	16.8704	5.9646	-70.9640	-29.4742	-62.8370	to	-34.6290
GRP06	8	-3.0	15.0494	5.3208	-28.9075	10.9893	-15.6265	to	9.5367
GRP07	8	-35.2	32.0027	11.3147	-75.1929	-2.8843	-62.0054	to	-8.4957
GRP09	8	-20.4	26.7577	9.4603	-54.1537	29.7101	-42.8272	to	1.9127
GRP10	8	53.3	93.0226	32.8885	2.8630	281.6794	-24.3710	to	131.1663
GRP11	8	-23.7	29.6738	10.4913	-74.3409	4.7812	-48.5118	to	1.1039
GRP12	8	-29.3	26.6521	9.4230	-62.1917	16.4814	-51.6644	to	-7.1011
GRP13	8	95.8	141.8003	50.1340	-20.3724	405.4476	-22.6789	to	214.4167
GRP14	8	19.3	84.6794	29.9387	-44.8732	215.9801	-51.4425	to	90.1447
GRP15	8	144.4	198.7220	70.2589	16.1278	605.6229	-21.7181	to	310.5527
GRP16	8	-21.4	24.8829	8.7974	-59.3803	14.6158	-42.2941	to	-0.6889
GRP17	8	-28.7	35.3053	12.4823	-69.3740	18.9149	-58.2774	to	0.7545
GRP18	8	-13.9	26.8431	9.4905	-55.2565	13.3016	-36.4282	to	8.4545
GRP19	8	6.9	55.5243	19.6308	-53.5774	114.4675	-39.5099	to	53.3288
GRP20	8	-29.2	38.7198	13.6895	-83.8653	20.0069	-61.6635	to	3.0776
Total	136	±37.6	84.4843	7.2445	-83.8653	605.6229	-14.3281	to	14.3266

TABLE 5.8

PERC.DIFF. SAND1

Variable: SAND1
by Variable LAB

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	12	38205.7691	3183.8141	3.168	0.0006	VERY SIGN.
Within groups	117	117592.1999	1005.0615			
Total	129	155797.9700				

Group	Count	(%) Mean	95% conf int	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP01	10	50.1	±51.6	72.1441	22.8140	1.0000	202.0000	-1.5087	to	101.7087
GRP02	10	2.7	12.6	17.6890	5.5937	-19.0000	45.0000	-9.9539	to	15.3539
GRP05	10	-20.6	15.9	22.3020	7.0525	-64.0000	0.0000	-36.5539	to	-4.6461
GRP06	10	-6.4	9.6	13.4098	4.2405	-29.0000	12.0000	-15.9928	to	3.1928
GRP07	10	-11.1	9.1	12.7754	4.0399	-32.0000	0.0000	-20.2390	to	-1.9610
GRP08	10	1.8	18.4	25.7155	8.1320	-29.0000	70.0000	-16.5958	to	20.1958
GRP10	10	-10.8	10.7	14.9874	4.7394	-40.0000	3.0000	-21.5213	to	-0.0787
GRP11	10	-0.2	11.3	15.7818	4.9907	-29.0000	35.0000	-11.4896	to	11.0896
GRP12	10	-19.8	16.5	22.9773	7.2661	-64.0000	0.0000	-36.2369	to	-3.3631
GRP13	10	-2.2	13.9	19.4981	6.1659	-39.0000	29.0000	-16.1481	to	11.7481
GRP14	10	12.3	29.9	41.7454	13.2011	-21.0000	122.0000	-17.5628	to	42.1628
GRP18	10	6.5	36.9	51.5348	16.2967	-40.0000	147.0000	-30.3657	to	43.3657
GRP19	10	-2.1	11.7	16.3126	5.1585	-40.0000	14.0000	-13.7693	to	9.5693
Total	130	±11.3	±19.1	34.7525	3.0480	-64.0000	202.0000	-6.0151	to	6.0459

PERC.DIFF. SAND1 ANBO EXCLUDED.

Variable: SAND1
by Variable LAB

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	12	27370.6154	2280.8846	2.777	0.0029	VERY SIGN.
Within groups	91	74738.3750	821.3008			
Total	103	102108.9900				

Group	Count	(%) Mean	95% conf int	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP01	8	48.7	±68.2	81.6416	28.8647	1.0000	202.0000	-19.5040	to	117.0040
GRP02	8	-2.1	9.1	10.8685	3.8426	-19.0000	10.0000	-11.2113	to	6.9613
GRP05	8	-12.6	12.9	15.4359	5.4574	-40.0000	0.0000	-25.5297	to	0.2797
GRP06	8	-7.1	10.6	12.6315	4.4659	-29.0000	1.0000	-17.6851	to	3.4351
GRP07	8	-9.2	11.0	13.1990	4.6666	-32.0000	0.0000	-20.2846	to	1.7846
GRP08	8	-4.7	8.4	10.0534	3.5544	-29.0000	2.0000	-13.1549	to	3.6549
GRP10	8	-8.2	13.3	15.8633	5.6085	-40.0000	3.0000	-21.5120	to	5.0120
GRP11	8	-4.2	9.3	11.1066	3.9268	-29.0000	3.0000	-13.5354	to	5.0354
GRP12	8	-10.8	11.9	14.2472	5.0371	-40.0000	0.0000	-22.7859	to	1.0359
GRP13	8	6.0	8.4	10.0000	3.5355	0.0000	29.0000	-2.3602	to	14.3602
GRP14	8	19.0	37.1	44.4072	15.7003	-5.0000	122.0000	-18.1253	to	56.1253
GRP18	8	-10.1	13.8	16.4529	5.8170	-40.0000	5.0000	-23.8799	to	3.6299
GRP19	8	-4.2	14.5	17.3102	6.1201	-40.0000	14.0000	-18.7217	to	10.2217
Total	104	±11.3	±17.6	31.4857	3.0874	-40.0000	202.0000	-6.1136	to	6.1328

TABLE 5.9

Variable: SAND2
by Variable LAB

PERC.DIFF. SAND2.

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	16	97280.3763	6080.0235	5.468	0.0000	VERY SIGN.
Within groups	153	170117.5997	1111.8797			
Total	169	267397.9800				

Group	Count	Mean (%)	95% conf int	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP03	10	29.8	±25.7	35.9438	11.3664	-1.0000	92.0000	4.0874	to	55.5126
GRP04	10	-18.7	13.3	18.8034	5.9461	-44.0000	3.0000	-32.1511	to	-5.2489
GRP05	10	-18.2	16.9	23.5881	7.4592	-63.0000	2.0000	-35.0739	to	-1.3261
GRP06	10	-9.8	9.2	12.8478	4.0628	-36.0000	1.0000	-18.9908	to	-0.6092
GRP07	10	-15.5	14.2	19.8228	6.2685	-58.0000	0.0000	-29.6804	to	-1.3196
GRP09	10	61.1	50.6	70.7302	22.3669	2.0000	154.0000	10.5027	to	111.6973
GRP10	10	-10.8	10.7	14.9948	4.7418	-36.0000	3.0000	-21.5266	to	-0.0734
GRP11	10	6.1	22.4	31.2497	9.8820	-36.0000	87.0000	-16.2547	to	28.4547
GRP12	10	-24.6	17.4	24.3274	7.6930	-63.0000	-2.0000	-42.0028	to	-7.1972
GRP13	10	-13.4	16.2	22.6676	7.1681	-58.0000	8.0000	-29.6154	to	2.8154
GRP14	10	9.2	21.1	29.5552	9.3462	-13.0000	75.0000	-11.9425	to	30.3425
GRP15	10	50.6	57.7	80.7853	25.5466	-4.0000	202.0000	-7.1903	to	108.3903
GRP16	10	-6.4	13.1	18.3739	5.8103	-44.0000	14.0000	-19.5439	to	6.7439
GRP17	10	-13.0	12.8	17.9258	5.6686	-44.0000	4.0000	-25.8233	to	-0.1767
GRP18	10	-7.0	10.2	14.3139	4.5265	-36.0000	13.0000	-17.2396	to	3.2396
GRP19	10	-4.0	7.4	10.3064	3.2592	-21.0000	11.0000	-11.3728	to	3.3728
GRP20	10	-15.2	15.4	21.5035	6.8000	-58.0000	2.0000	-30.5827	to	0.1827
Total	170	±18.4	±19.7	39.7773	3.0508	-63.0000	202.0000	-6.0108	to	6.0343

Variable: SAND2
by Variable LAB

PERC.DIFF. SAND2. ANDO EXCLUDED.

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	16	31521.5588	1970.0974	2.541	0.0021	VERY SIGN.
Within groups	119	92267.3751	775.3561			
Total	135	123788.9300				

Group	Count	Mean (%)	95% conf int	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP03	8	14.8	±16.4	19.6573	6.9499	-1.0000	53.0000	-1.5589	to	31.3089
GRP04	8	-12.5	12.8	15.3250	5.4182	-36.0000	3.0000	-25.3120	to	0.3120
GRP05	8	-8.8	11.9	14.2271	5.0300	-36.0000	2.0000	-20.7691	to	3.0191
GRP06	8	-8.1	11.7	14.0045	4.9513	-36.0000	1.0000	-19.8330	to	3.5830
GRP07	8	-8.8	11.3	13.4636	4.7601	-36.0000	0.0000	-20.1308	to	2.3808
GRP09	8	41.6	54.5	65.2707	23.0767	2.0000	154.0000	-12.9426	to	96.1926
GRP10	8	-8.1	11.7	14.0045	4.9513	-36.0000	3.0000	-19.8330	to	3.5830
GRP11	8	-3.8	12.0	14.3769	5.0830	-36.0000	8.0000	-15.8944	to	8.1444
GRP12	8	-15.8	15.0	17.9558	6.3483	-52.0000	-2.0000	-30.8864	to	-0.8636
GRP13	8	-4.6	11.7	13.9585	4.9351	-36.0000	8.0000	-16.2946	to	7.0446
GRP14	8	14.0	26.3	31.4461	11.1179	-5.0000	75.0000	-12.2895	to	40.2895
GRP15	8	29.1	58.7	70.2698	24.8441	-4.0000	202.0000	-29.6219	to	87.8719
GRP16	8	-2.5	12.1	14.4519	5.1095	-36.0000	14.0000	-14.5821	to	9.5821
GRP17	8	-6.3	10.5	12.5121	4.4237	-27.0000	4.0000	-16.8354	to	4.0854
GRP18	8	-10.1	11.7	13.8403	4.8933	-36.0000	6.0000	-21.6957	to	1.4457
GRP19	8	-2.0	8.7	10.4471	3.6936	-21.0000	11.0000	-10.7340	to	6.7340
GRP20	8	-7.3	12.0	14.3819	5.0848	-36.0000	2.0000	-19.3985	to	4.6485
Total	136	±11.7	±18.2	30.2813	2.5966	-52.0000	202.0000	-5.1132	to	5.1573

TABLE 6. Analysis of variance of CEC and CLAY values versus METHODS.

6.1	CEC	(direct values)	vs.	six methods
	CEC	(% deviations)	vs.	ditto
6.2	CEC	(% deviations)	vs.	two methods
	CEC	(")	vs.	two methods
6.3	CLAY	(% deviations)	vs.	H_2O_2 treatment
	CLAY	(")	vs.	use of clay/silt sieve
6.4	CLAY	(% deviations)	vs.	removal of carbonate
	Ditto, without andosol			
6.5	CLAY	(% deviations)	vs.	three mechanical dispersion techniques
	Ditto		vs.	two techniques
6.6	CLAY	(% deviations)	vs.	three methods of clay measurement
	Ditto		vs.	two methods

TABLE 6.1 CEC (direct values) vs. six methods
CEC (% deviations) vs. ditto

- O N E W A Y - - - -

Variable: CEC
by Variable METHOD

CEC VALUES BY METHODS.

GRP 1. NH_4-acetate pH7. Determination with Na^+.
2. Effective CEC (bases + H + Al)
3. Other methods
4. NH_4-acetate pH7. Determination with NH_4^+.
5. Compulsive exchange (Gillman, 1979)
6. $CaCl_2$ pH7.

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	5	1470.4107	294.0821	1.137	0.3423	NOT SIGN.
Within groups	194	50191.0352	258.7167			
Total	199	51661.4460				

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP01	20	17.8550	19.2639	4.3075	1.1000	72.9000	8.8392	to	26.8708
GRP02	20	12.3650	11.0136	2.4627	1.5000	43.6000	7.2105	to	17.5195
GRP03	26	19.7154	18.3329	3.5954	2.2000	71.7000	12.3106	to	27.1202
GRP04	114	16.7342	16.0806	1.5061	2.0000	70.5000	13.7504	to	19.7180
GRP05	10	7.6500	5.5402	1.7520	1.3000	18.9000	3.6868	to	11.6132
GRP06	10	18.3600	18.0643	5.7124	3.0000	62.0000	5.4376	to	31.2824
Total	200	16.4240	16.1123	1.1393	1.1000	72.9000	14.1773	to	18.6707

- O N E W A Y -

Variable: CEC (% diff.)
by Variable METHOD

PERC.DIFF. CEC VALUES BY METHODS.

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	5	27969.3387	5593.8677	7.697	0.0000	VERY SIGN.
Within groups	194	140983.9407	726.7213			
Total	199	168953.2800				

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP01	20	0.2000	35.3830	7.9119	-57.0000	48.0000	-16.3598	to	16.7598
GRP02	20	-14.6500	53.3057	11.9195	-77.0000	153.0000	-39.5979	to	10.2979
GRP03	26	1.0000	16.4754	3.2311	-42.0000	36.0000	-5.6546	to	7.6546
GRP04	114	5.1754	21.5830	2.0214	-40.0000	78.0000	1.1706	to	9.1803
GRP05	10	-44.2000	18.2562	5.7731	-74.0000	-12.0000	-57.2597	to	-31.1403
GRP06	10	10.3000	9.3339	2.9516	-8.0000	20.0000	3.6229	to	16.9771
Total	200	-0.0600	29.1378	2.0604	-77.0000	153.0000	-4.1229	to	4.0029

TABLE 6.2 CEC (% deviations) vs. two methods
CEC (,,) vs. two other methods

---------- O N E W A Y ----------

Variable: CEC (% diff.)
by Variable METHOD

GRP 2: Effective CEC
GRP 4: All methods excl. ECEC and Comp. Exch.

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	1	6394.1686	6394.1686	8.645	0.0037	VERY SIGN.
Within groups	188	139050.6719	739.6312			
Total	189	145444.8400				

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP02	20	-14.6500	53.3057	11.9195	-77.0000	153.0000	-39.5979	to	10.2979
GRP04	170	4.2529	22.4349	1.7207	-57.0000	78.0000	0.8561	to	7.6497
Total	190	2.2632	27.7408	2.0125	-77.0000	153.0000	-1.7067	to	6.2331

---------- O N E W A Y ----------

Variable: CEC (% diff.)
by Variable METHOD

GRP 4: All methods excl. ECEC and Comp.Exch.
GRP 5: Compulsive Exchange

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	1	22172.6042	22172.6040	44.818	0.0000	VERY SIGN.
Within groups	178	88061.7221	494.7288			
Total	179	110234.3300				

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP04	170	4.2529	22.4349	1.7207	-57.0000	78.0000	0.8561	to	7.6497
GRP05	10	-44.2000	18.2562	5.7731	-74.0000	-12.0000	-57.2597	to	-31.1403
Total	180	1.5611	24.8160	1.8497	-74.0000	78.0000	-2.0889	to	5.2111

TABLE 6.3 CLAY (% deviations) vs. H_2O_2 treatment
CLAY (,,) vs. use of clay/silt sieve

---------- ONEWAY ----------

Variable: CLAY (% diff.)
by Variable H202

H_2O_2 treatment

GRP 0. No H_2O_2 treatment
1. With treatment

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	1	123.1475	123.1475	0.089	0.7658	NOT SIGN.
Within groups	198	274017.6064	1383.9273			
Total	199	274140.7500				

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP 0	55	1.3091	25.0354	3.3758	-68.0000	91.0000	-5.4589	to	8.0771
GRP 1	145	-0.4483	40.8394	3.3915	-95.0000	264.0000	-7.1519	to	6.2553
Total	200	0.0350	37.1159	2.6245	-95.0000	264.0000	-5.1404	to	5.2104

---------- ONEWAY ----------

Variable: CLAY (% diff.)
by Variable SIEVE

Use of sieve to separate SILT & CLAY from SAND

GRP 1: SIEVE
2: NO SIEVE

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	1	1558.4817	1558.4817	1.132	0.2886	NOT SIGN.
Within groups	198	272582.2808	1376.6782			
Total	199	274140.7600				

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP 1	150	1.6467	39.3799	3.2154	-95.0000	264.0000	-4.7069	to	8.0003
GRP 2	50	-4.8000	29.1078	4.1165	-79.0000	50.0000	-13.0724	to	3.4724
Total	200	0.0350	37.1159	2.6245	-95.0000	264.0000	-5.1404	to	5.2104

TABLE 6.4 CLAY (% deviations) vs. pretreatment to remove carbonate
Ditto, without andosol

---------- O N E W A Y ----------

Variable: CLAY (% diff.)
by Variable CALC

REMOVAL OF CARBONATE

GRP 1. No treatment
2. Na-acetate pH5
3. HCl pH3

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	2	19141.2271	9570.6135	7.402	0.0008	VERY SIGN.
Within groups	195	252146.6875	1293.0599			
Total	197	271287.9100				

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP00	128	-3.8047	30.3396	2.6817	-88.0000	122.0000	-9.1112	to	1.5018
GRP01	40	18.8250	51.9758	8.2181	-57.0000	264.0000	2.2023	to	35.4477
GRP02	30	-10.2000	32.1026	5.8611	-95.0000	60.0000	-22.1873	to	1.7873
Total	198	-0.2020	37.1092	2.6372	-95.0000	264.0000	-5.4029	to	4.9988

---------- O N E W A Y ----------

Variable: CLAY (% diff.)
by Variable CALC

REMOVAL OF CARBONATE
(without andosol)

GRP 1. No treatment
2. Na-acetate pH5
3. HCl pH3

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	2	3369.4288	1684.7144	6.258	0.0024	VERY SIGN.
Within groups	155	41728.9313	269.2189			
Total	157	45098.3600				

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP00	102	-2.2843	17.4301	1.7258	-54.0000	41.0000	-5.7079	to	1.1393
GRP01	32	8.8438	8.5689	1.5148	-9.0000	26.0000	5.7543	to	11.9332
GRP02	24	-3.7917	19.5247	3.9855	-58.0000	18.0000	-12.0362	to	4.4529
Total	158	-0.2595	16.9485	1.3483	-58.0000	41.0000	-2.9227	to	2.4037

TABLE 6.5 CLAY (% deviations) vs. three mechanical dispersion techniques
CLAY (,,) vs. two techniques

---------- ONEWAY ----------

Variable: CLAY (% diff.)
by Variable SHK

SHAKING METHODS

GRP 1. Handshaking only
2. Mechanical shaking
3. Ultrasonic treatment

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	2	3866.2207	1933.1104	1.409	0.2468	NOT SIGN.
Within groups	197	270274.5298	1371.9519			
Total	199	274140.7500				

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP00	30	-3.7000	28.8613	5.2693	-81.0000	60.0000	-14.4770	to	7.0770
GRP01	141	-1.3262	38.2780	3.2236	-95.0000	264.0000	-7.6995	to	5.0470
GRP02	29	10.5172	38.2610	7.1049	-88.0000	122.0000	-4.0365	to	25.0709
Total	200	0.0350	37.1159	2.6245	-95.0000	264.0000	-5.1404	to	5.2104

---------- ONEWAY ----------

Variable: CLAY (% diff.)
by Variable SHK

SHAKING METHODS

GRP 1. Shaking
2. Ultrasonic treatment

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	1	3726.8353	3726.8353	2.729	0.1001	NOT SIGN.
Within groups	198	270413.9214	1365.7269			
Total	199	274140.7600				

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP01	171	-1.7427	36.7363	2.8093	-95.0000	264.0000	-7.2883	to	3.8029
GRP02	29	10.5172	38.2610	7.1049	-88.0000	122.0000	-4.0365	to	25.0709
Total	200	0.0350	37.1159	2.6245	-95.0000	264.0000	-5.1404	to	5.2104

TABLE 6.6 CLAY (% deviations) vs. three methods of clay determination
CLAY (,,) vs. two methods

- O N E W A Y -

Variable: CLAY (% diff.)
by Variable PIH

METHOD OF CLAY DETERMINATION

GRP 1. Pipette
2. Hydrometer
3. Sedimentometer

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	2	20466.4817	10233.2410	7.947	0.0005	VERY SIGN.
Within groups	197	253674.2748	1287.6867			
Total	199	274140.7600				

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP01	150	-4.2467	37.5496	3.0659	-95.0000	264.0000	-10.3049	to	1.8116
GRP02	40	6.0000	26.5938	4.2049	-68.0000	91.0000	-2.5051	to	14.5051
GRP03	10	40.4000	42.1721	13.3360	2.0000	122.0000	10.2319	to	70.5681
Total	200	0.0350	37.1159	2.6245	-95.0000	264.0000	-5.1404	to	5.2104

- O N E W A Y -

Variable: CLAY (% diff.)
by Variable PIH

METHOD OF CLAY DETERMINATION

GRP 1. Pipette
2. Hydrometer

Analysis of Variance

Source	D.f.	Sum of squares	Mean squares	F-ratio	F-prob.	
Between groups	1	3315.6056	3315.6056	2.623	0.1070	NOT SIGN.
Within groups	188	237667.8748	1264.1908			
Total	189	240983.4800				

Group	Count	Mean	Standard deviation	Standard error	Minimum	Maximum	95% conf int for mean		
GRP01	150	-4.2467	37.5496	3.0659	-95.0000	264.0000	-10.3049	to	1.8116
GRP02	40	6.0000	26.5938	4.2049	-68.0000	91.0000	-2.5051	to	14.5051
Total	190	-2.0895	35.7078	2.5905	-95.0000	264.0000	-7.1995	to	3.0206

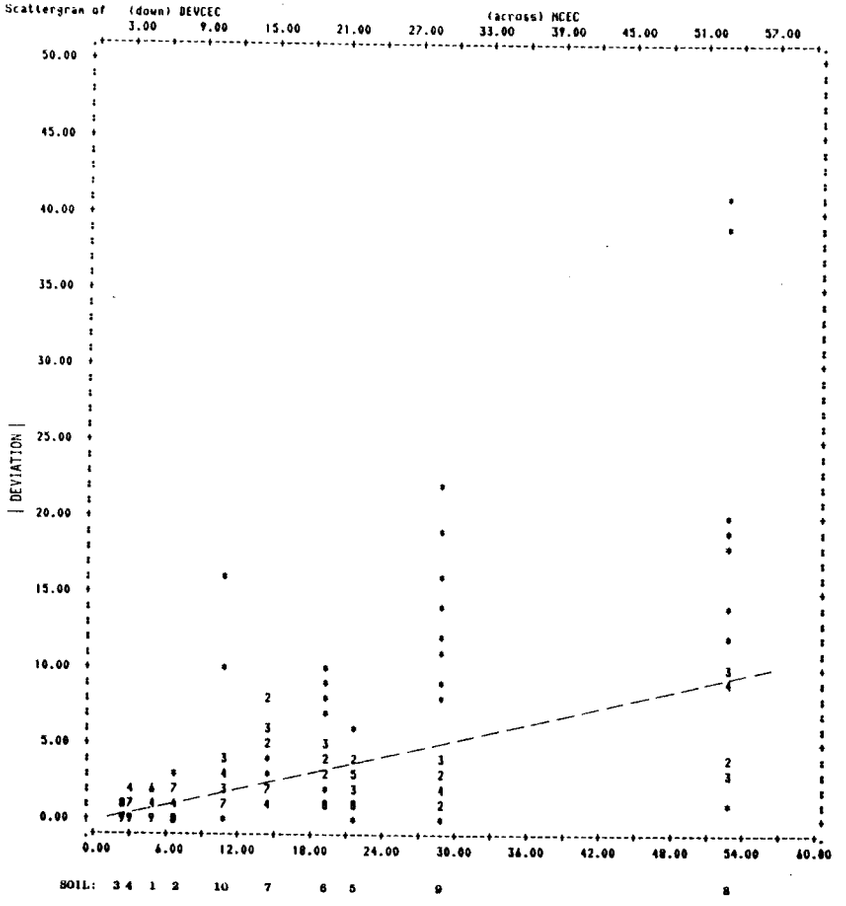


Fig. 1.1 CEC (me/100g)

SPSS Batch System

Statistics:

Correlation (R)-	0.60512	R squared -	0.36618	Significance -	0.00000
Std err of est -	4.44619	Intercept (a) -	-0.27393	Slope (b) -	0.22919
Plotted values -	200	Excluded values-	0	Missing values -	0

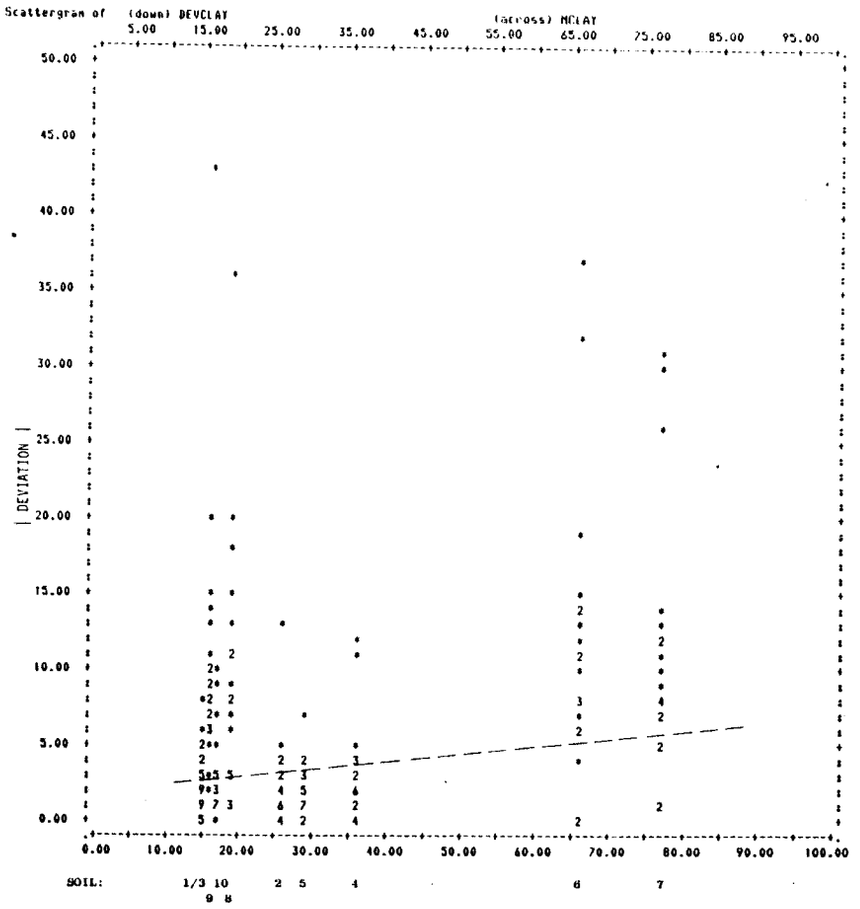


Fig. 1.2 CLAY CONTENT (wt%)

SPSS Batch System

Statistics:

Correlation (R)-	0.34911	R squared -	0.12187	Significance -	0.00000
Std err of est -	6.60698	Intercept (a) -	2.02490	Slope (b) -	0.11564
Plotted values -	200	Excluded values-	0	Missing values -	0

FIGURE 1. Scattergram of DEVIATIONS from the mean of data for each soil (absolute figures) versus these MEANS.

These diagrams show the deviations from the mean of parameter data, while by a simple regression analysis a correlation of these deviations with the magnitude of the parameter is calculated. Figures inside the diagram represent number of data plotted on that place.

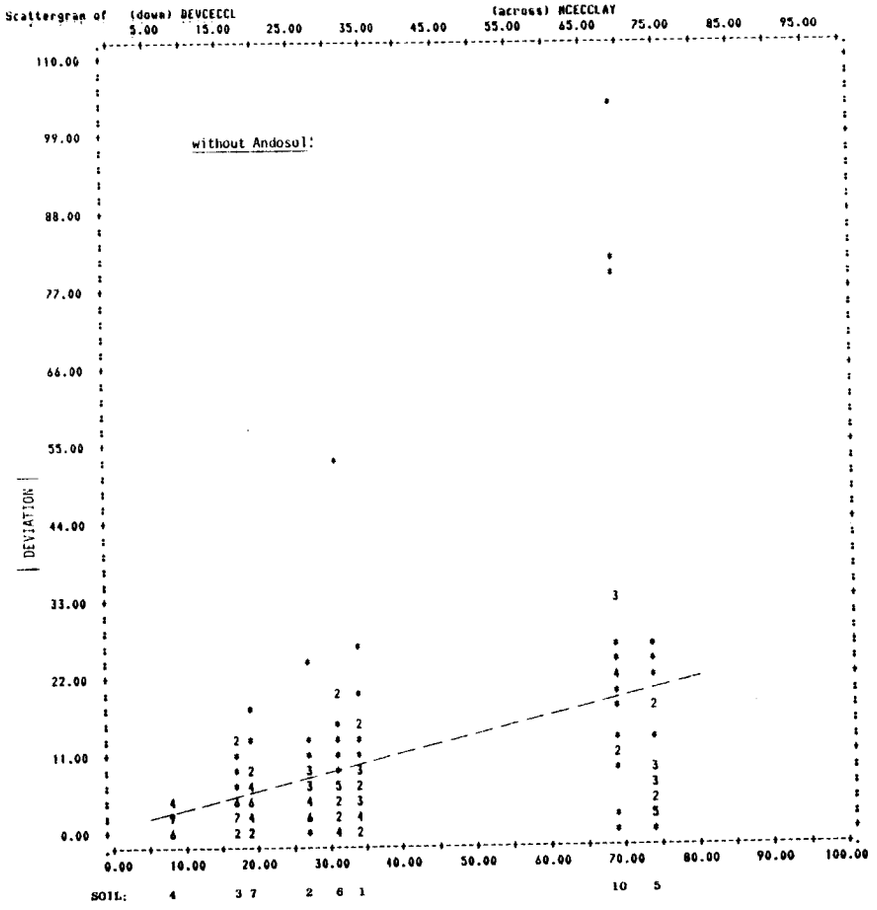


Fig. 1.3 CEC of the CLAY (me/100g)

SPSS Batch System

Statistics:

Correlation (R)-	0.42264	R squared -	0.17863	Significance -	0.00000
Std err of est -	12.50209	Intercept (a) -	0.38365	Slope (b) -	0.25745
Plotted values -	160	Excluded values-	0	Missing values -	0

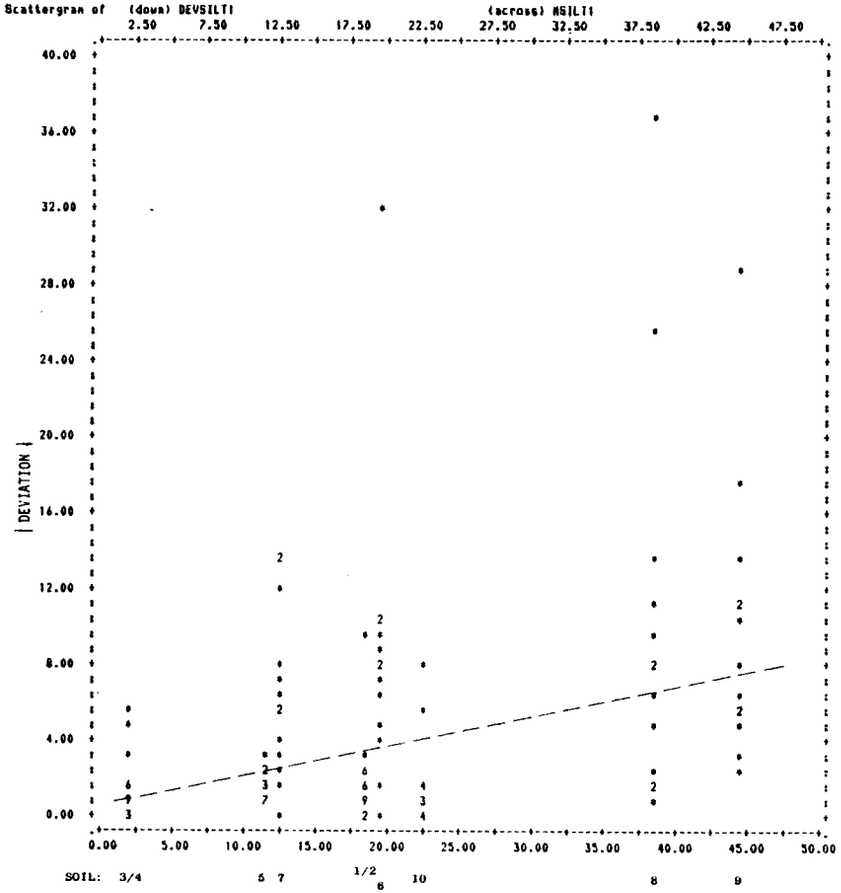


Fig. 1.4 SILT 1 (wt%)

SPSS Batch System

Statistics:

Correlation (R)-	0.45408	R squared -	0.20619	Significance -	0.00000
Std err of est -	5.46673	Intercept (a) -	0.36263	Slope (b) -	0.21069
Plotted values -	130	Excluded values-	0	Missing values -	70

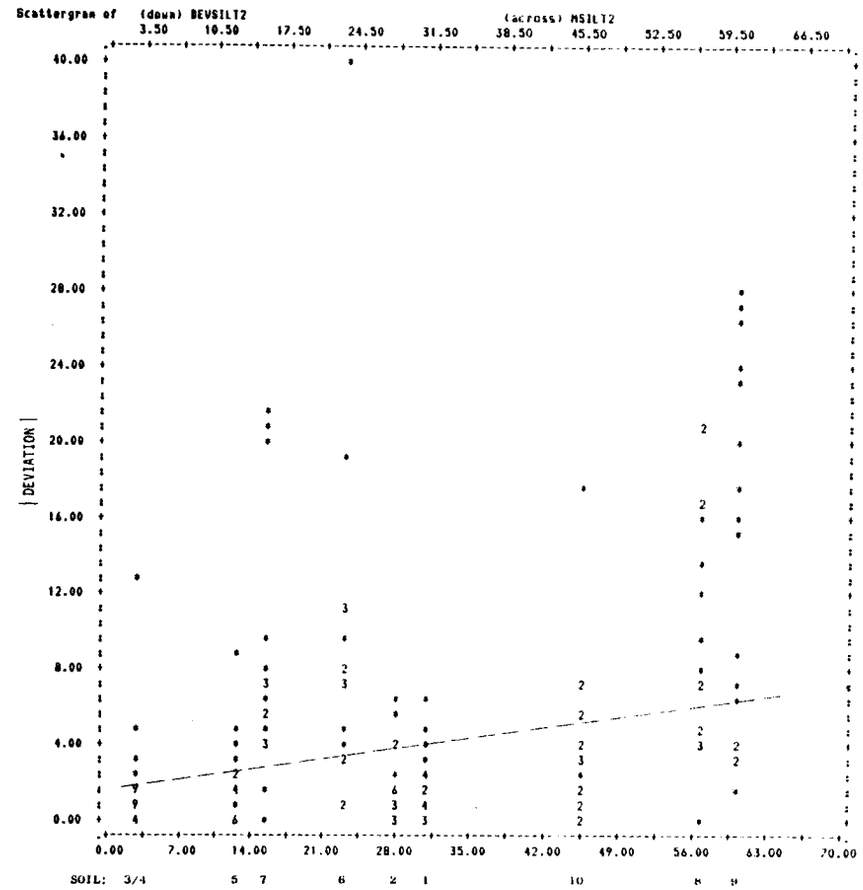


Fig. 1.5 SILT 2 (wt)

SPSS Batch System

Statistics:

Correlation (R)-	0.42130	R squared -	0.17749	Significance -	0.00000
Std err of est -	6.18943	Intercept (a) -	1.41881	Slope (b) -	0.14491
Plotted values -	170	Excluded values-	0	Missing values -	30

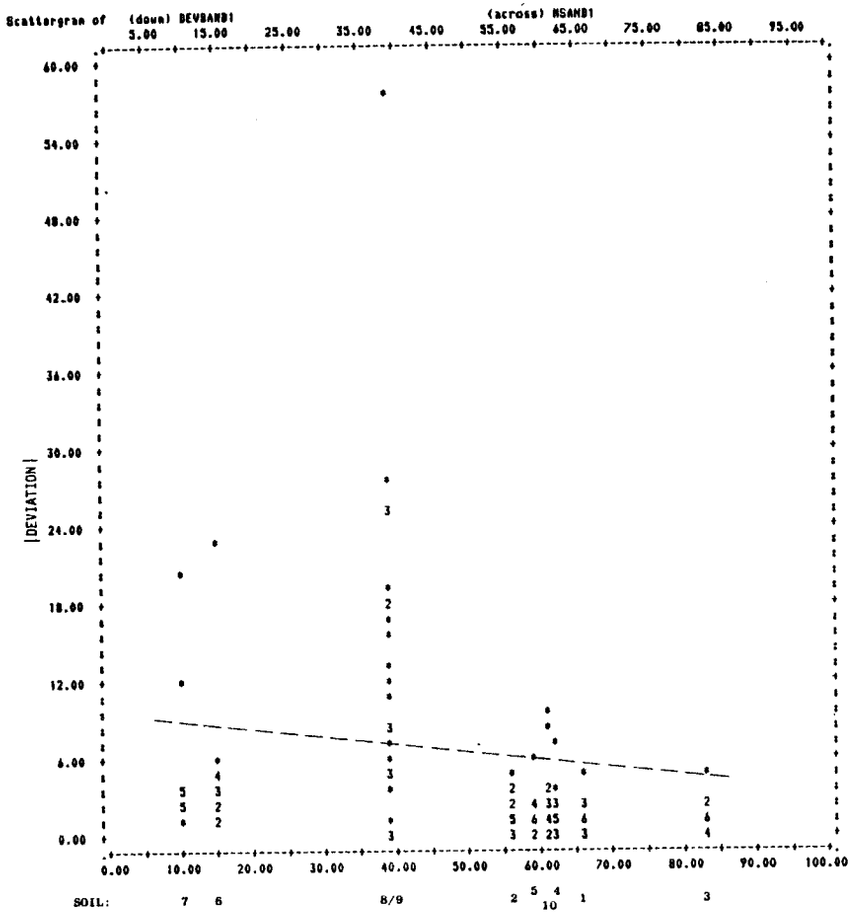


Fig. 1.6 SAND 1 (wt%)

SPSS Batch System

Statistics:

Correlation (R)-	-0.29254	R squared	-	0.08558	Significance	- 0.00037
Std err of est -	7.22360	Intercept (a)	-	9.63341	Slope (b)	- -0.10016
Plotted values -	130	Excluded values-		0	Missing values	- 70

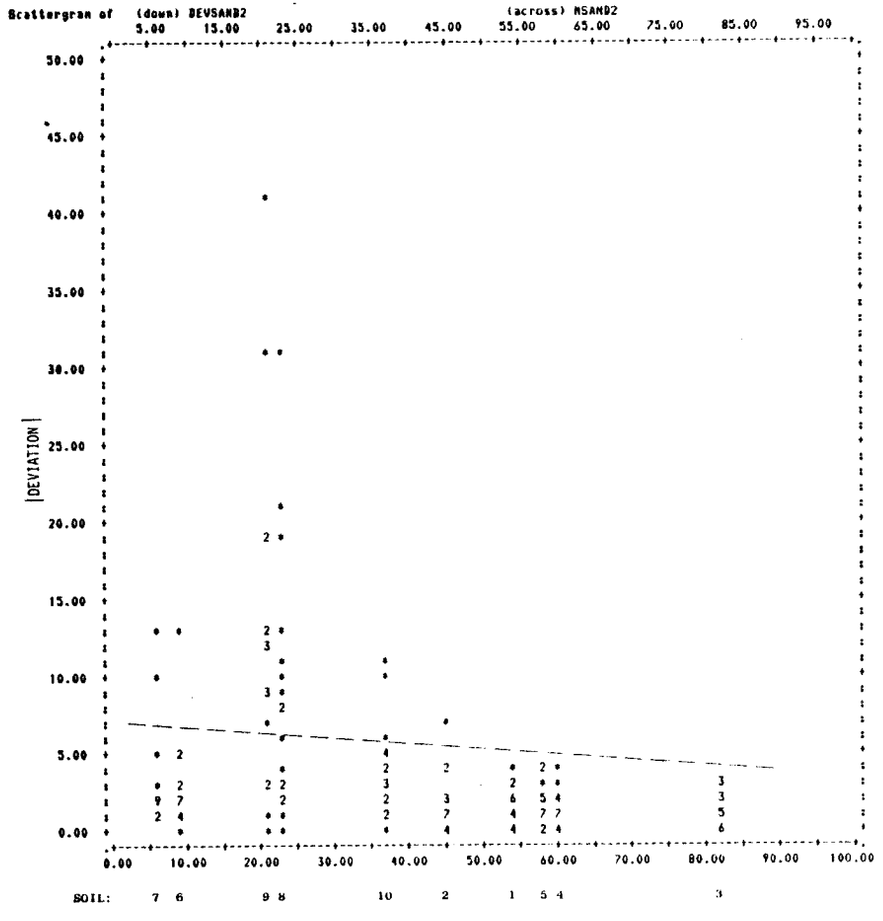


Fig. 1.7 SAND 2 (wt)

SPSS Batch System

Statistics:

Correlation (R)-	-0.33676	R squared	-	0.11341	Significance	- 0.00000
Std err of est -	5.43823	Intercept (a)	-	7.21745	Slope (b)	- -0.08288
Plotted values -	170	Excluded values-		0	Missing values	- 10

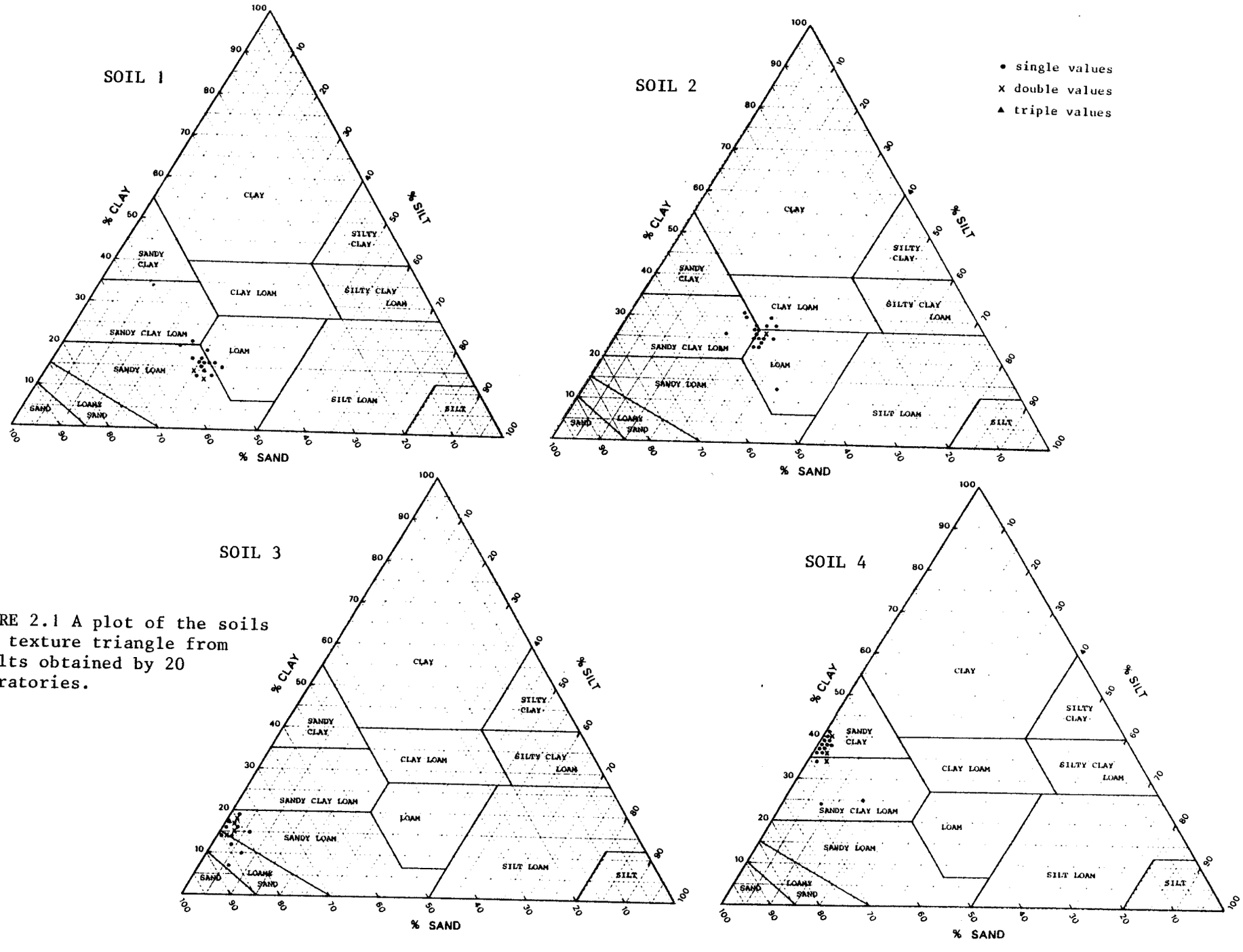
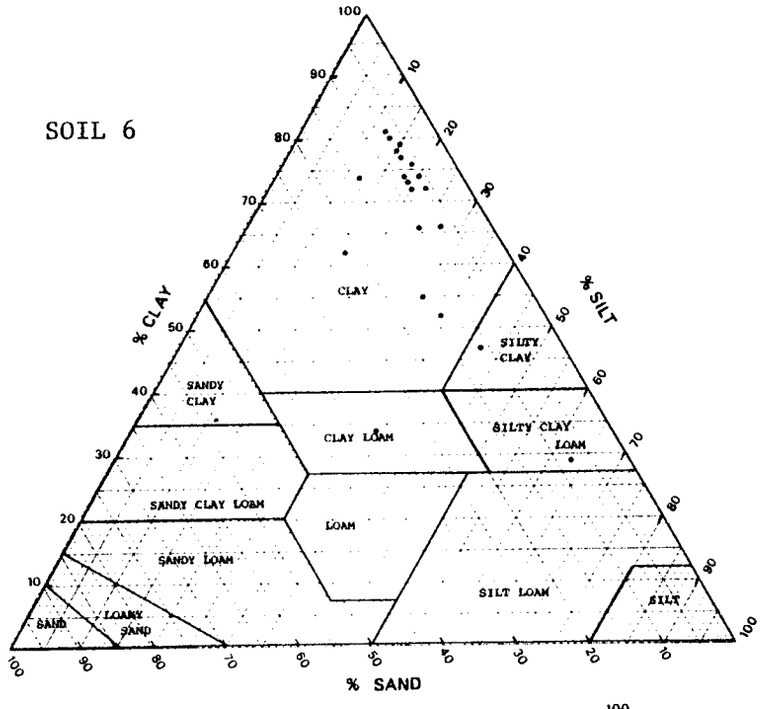
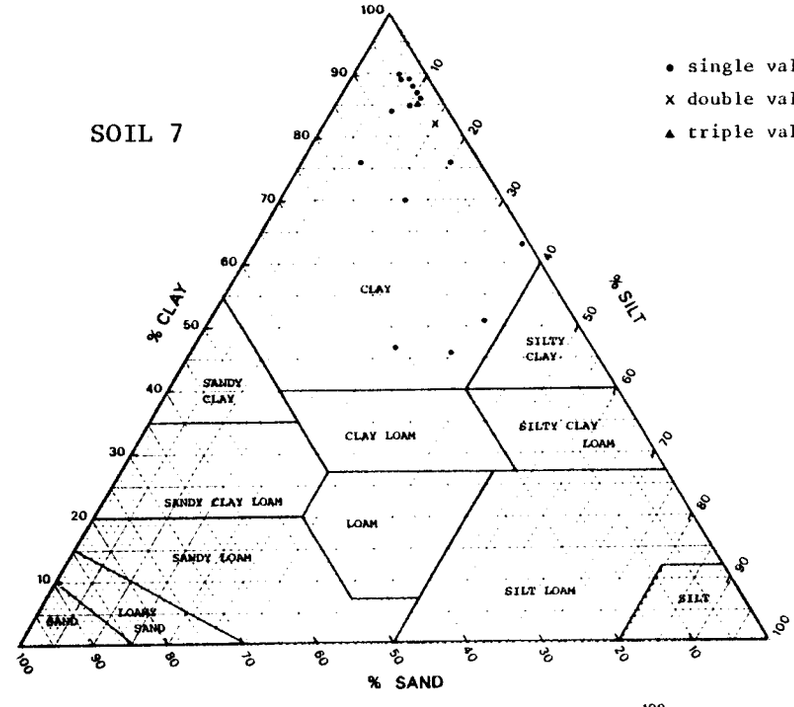
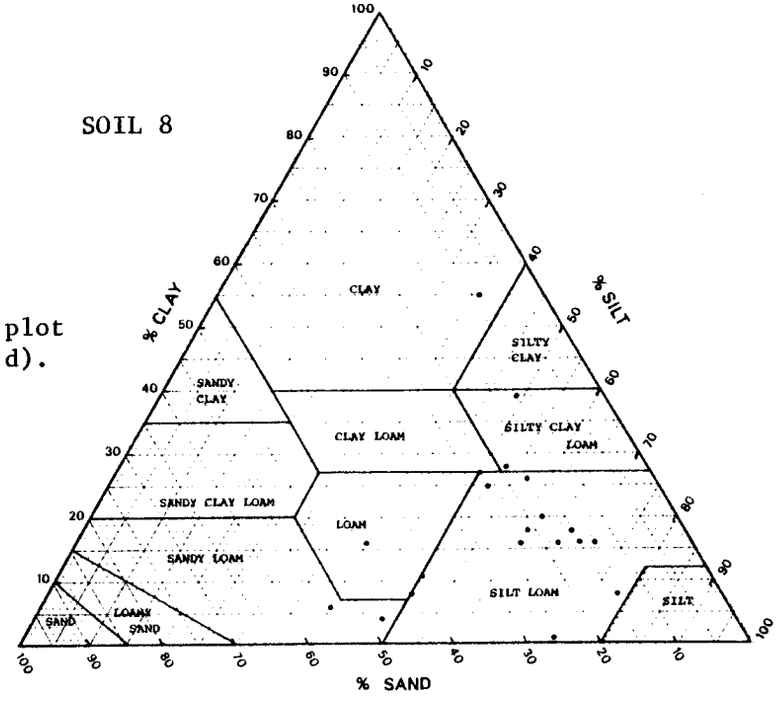


FIGURE 2.1 A plot of the soils in a texture triangle from results obtained by 20 laboratories.







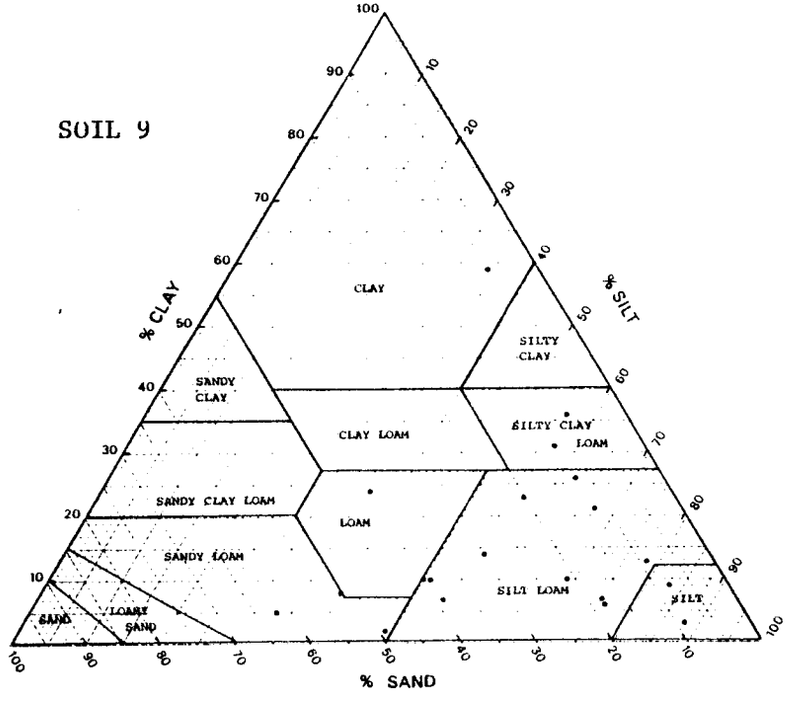


FIGURE 2.2 Texture plot (cont'd).

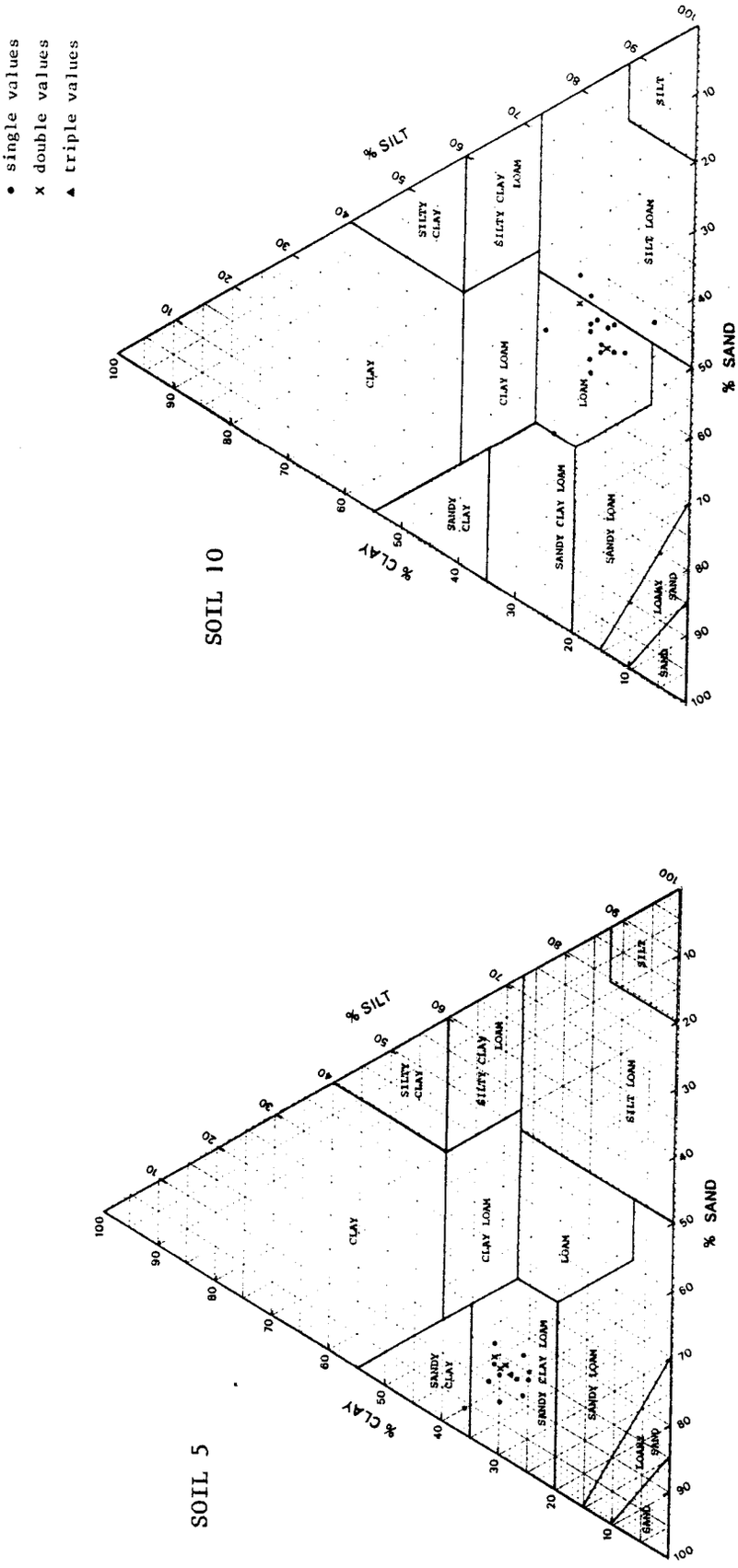


FIGURE 2.3 Texture plot (cont'd).

APPENDIX I[a].

CATION EXCHANGE CAPACITY (CEC) METHODS

Lab	Method	Sample weight	Saturating technique	Contact time	Procedure
1	NH_4OAc pH7	10 g (or 5 g)	leaching tube	5-6 hrs	2x50ml NH_4OAc pH7, 150ml 85-90% ethanol (final 30ml 95%). Then 2x50ml 0.1N K_2SO_4, NH_4 by distill. and titr.
2	Compulsive exchange	2 g	centrifuge tube	2 hrs	20ml .1M $BaCl_2$ (+ some NH_4Cl), 3x20ml .002M $BaCl_2$ (shake 1hr.). Then 10ml .005M $MgSO_4$, measure $MgCl_2$.
3	NaOAc pH8.2	2.5 g	leaching tube	1 drop/3sec	(100ml ethanol 75% if $EC_{2.5}$ > 0.8mS/cm) 4x25ml 1N NH_4OAc pH7, 4x25ml NaOAc pH8.2, 100ml ethanol (1:1), 4x25ml NH_4OAc pH7, measure Na.
4	Sum of bases	10 g (?)	erlenmeyer	overnight	100ml 1N KCl: measure Ca & Mg by EDTA titration. 0.05N HCl + 0.025N H_2SO_4: K & Na flamephotometrically. 150 ml CaOAc pH 7, titrate with NaOH for (H + Al).
5	NH_4OAc pH7	5 g	leaching tube	> 1 hr	230ml 1M NH_4OAc pH7, 200ml ethanol. Then 230ml 1N NaCl. Distill for NH_4 by titration or autoanalyzer.
6	NH_4OAc pH7	5 g	filter funnel	2-24 hrs	(100ml ethanol 80% if EC_5>0.5mS/cm) 10x20ml 1N NH_4OAc pH7, 4x25ml ethanol 80%, 4x20ml 1N KCl pH2.5. NH_4 by autoanalyzer.
7	NH_4OAc pH7	5 g	leaching tube	1½ hr/100ml	100ml ethanol 1:1, 100ml 1N NH_4OAc pH7 /ethanol 1:1, 200ml 1N NaOAc pH7, 100ml ethanol 96%, 98 ml 1N NH_4OAc, measure Na.
8	NH_4OAc pH7	3-8 g	leaching tube (after Schollenberger)	4-24 hrs	100ml 1N NH_4OAc pH7, 50ml 80% ethanol, 100ml 10% KCl, distill for NH_4 by titration.
9	Effective CEC	5 g	centrifuge tube	2 hrs	30ml 1N NH_4OAc pH7 (repeat 2x), determine Na, K, Mg and Ca in supernatants. 30ml 1N KCl (repeat 2x), determine acidity by titration; Al by titration after addition NaF.
10	$CaCl_2$ pH7	20 g	filter funnel (?)	?	20x50ml 1N $CaCl_2$ pH7 (with TEA+HNO_3), 250ml .01N $CaCl_2$ (unbuff.), 1000ml 1N KNO_3, Ca by autoanalyzer.
11	NH_4OAc pH7	2.5 g	automatic extractor	overnight	extract with ca 70ml 1N NH_4OAc pH7, then 2x ca 70ml ethanol 95% (45 mins. each). Distill sample and titr. NH_4.
12	NH_4OAc pH7 & 8.2 and NaOAc pH8.2	?	centrifuge		details unknown.
13	NH_4OAc pH7	5 g	leaching tube	1½ hr/100ml	method virtually the same as lab 7.
14	NH_4OAc pH7	5 g	extraction bottle	overnight	30ml 1N NH_4OAc, filter on büchner funnel, 5x30ml 1N NH_4OAc, 2x30ml ethanol 95%, Distill sample, NH_4 by titr.
15	Effective CEC	10 g	extracting bottle	1 hr	100ml NH_4OAc pH7, filtrate. In extract measure Na, K, Ca, Mg. Make similar extract with 1N CaOAc pH7. Titrate for (H + Al).
16	NH_4OAc pH7	5 g	leaching tube	overnight	2x25ml 1N NH_4OAc pH 7 (overnight with 2nd 25ml), 100ml 95% ethanol, distill sample and titrate NH_4.
17	NH_4OAc pH7	5 g	leaching tube	?	5x20ml 1N NH_4OAc pH7, 8x20ml ethanol, distill sample and titrate NH_4.
18	NH_4OAc pH7	5 g	centrifuge tube	shake ½ hr stand 12 hrs	25ml 1N NH_4OAc, 5x25ml of same (shake 10 min.), 3x50ml propanol, 5x25ml propanol. Then 5x25ml 10% KCl, distill extract and titr. NH_4.
19	NH_4OAc pH7	25 g	erlenmeyer	overnight	50ml 1N NH_4OAc pH7, filtrate. Leach with 1N NH_4OAc pH7 until 250ml. Then 4x?ml 1N NH_4Cl, 1x .25N NH_4Cl, 2x small portions ethanol 80%, then 95% until leachate free of Cl^-. Distill sample and titrate NH_4.
	NaOAc pH8.2 (calc. soils)	5 g	centrifuge tube	5 min/wash	5x30ml 1N NaOAc pH 8.2, 4x30ml ethanol, 3x30ml NH_4OAc pH7, measure Na.
20	NH_4OAc pH7	10 g	erlenmeyer	overnight	250ml 1N NH_4OAc pH7, filtrate by büchner funnel (leach further until neg. test for Ca with NH_4oxal.). Then leach 4x with 1N NH_4Cl pH7, 1x with .25 of same, 150-200ml isopropylalcohol (Cl-test!). Leach with acidified 10% NaCl (.005 ^{4}HCl), distill leachate and titrate NH_4.

APPENDIX I[b].

METHODS OF PARTICLE SIZE ANALYSIS

Lab	Sample[1] weight	H_2O_2[2]	Carbonate removal	Dispersing agent	High speed stirrer	Shaking procedure	Time	Separation silt & clay from sand[3]	Clay & silt determination	Remarks
1	10 or 20g	60ml 5%		5ml calgon 5% / 5ml 1N NaOH	15 min			decantation	pipette	
2	25 g	(option. McIntyre & Loveday '74)[5]		5ml 1N NaOH + 10ml 10% Na-tripolyphosph. +200ml water		reciprocating (350 str./min)	16 hrs	decantation	pipette	
3	50 g			50ml calgon (overnight standing)		end-over-end	10 min		hydrometer	sand by diff.
4	50 g			25ml N NaOH (or calgon) overnight standing	15 min			53 µm sieve	hydrometer	sand by diff.
5	ca 20 g	3ml 30% pH 3.5[4]		12.5ml Na-polymetaphosph. 0.5-5 g/l		by hand + short mechanical + ul.sonic		sieve	sedimentometer	sample preferably field-moist
6	10 ml	yes, in oven		10ml calgon 5% + 190ml water		stirring + ultrasonic	10 min	50 µm sieve	pipette	
7	20 g	30ml 15%	NaOAc pH5 (all samples)	25 ml 0.1N Na-pyrophosphate		reciprocating	16 hrs	50 µm sieve	pipette	
8	10 g	70 ml 8.5%		25ml 0.4 N calgon		mechanical + ultrasonic	2 hrs	decantation	pipette	sand by wet-sieving
9	51 g			50ml 5% Na-hexametaphosph + 100ml water	15 min				hydrometer	sand by diff.
10	20 g	yes		40ml 4% Na-hexametaphosphate		rotating (40 r.p.m.)	4 hrs	siphon	pipette	
11	10 g	50ml water + few ml, repeat	NaOAc pH5 (opt.)	10ml 4% calgon, after drying at 105°C		reciprocating (120 str./min)	16 hrs	300mesh sieve	pipette	shake 6 min before pipett.
12	?			Na-hexametaphosphate					pipette/succ. sedimentation	
13	20 g	75ml 20%	1N HCl/wash	10ml 5% calgon		by hand / mechanical	1 min	50 µm sieve	pipette	
14	52 g			10ml 17% calgon + 550ml water		mechanical 1 hr; next day 15 min			hydrometer	sand by diff.
15	10 g	25ml 30% (if O.M.>0.2%)		20ml 4.5% calgon + water to 300ml	15 min			no.70 sieve	pipette	sample oven-dry
16	10 g	method virtually the same as lab 11.								
17	10 g	50ml 10%, then 25ml 30%	170ml 0.1N HCl	Decant, 20ml $Na_4P_2O_7$ 0.8%, boil 5 min.				50 µm sieve	pipette	
18	20 g (pretreated)	Pretreat 50g with 6%	HCl pH3 (opt.)	75ml 0.4 N $Na_4P_2O_7$ + water to 750ml		reciprocating (?)	6 hrs (leave overn.)	Pipetting, then wet-sieving of sand		If Fe_d>1%: dithionite treat
19	10 g	5ml 30%, wash and oven-dry		10ml 5% calgon, dilute to 300ml		reciprocating	6 hrs	300mesh sieve	pipette	
20	10 g	few ml 30%, wash and oven-dry		10ml 5% calgon, dilute to 180ml		reciprocating	16 hrs	50 um sieve	pipette	

[1] air-dry fine earth unless otherwise stated.

[2] all with subsequent increments unless otherwise stated.

[3] sand by dry-sieving unless otherwise stated.

[4] unless carbonate is present.

[5] Methods for analysis of irrigated soils. Techn. Comm. 54, Commonw. Bur. of Soils, CSIRO, Canberra, Australia.

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