RESEARCH NEWS

POSSIBLE SOURCES OF ERRORS IN CHEMICAL ANALYSES OF IUFRO PLANT SAMPLES

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In 1970, the International Union of Forestry Research Organizations (IUFRO), Section 21, Working Group 3 began an international comparison of methods for plant analysis. Duplicates of three samples of tree foliage were analyzed by various member institutions; the methods used and results obtained were compiled in a report (van Goor *et al.*, 1971).

The comparison did not permit adequate statistical treatment of data and in 1971-1972, IUFRO revised the method to enable calculation of the analytical precision of each participating laboratory. Two batches of leaf and needle samples were distributed within an interval of a few months. The first series consisted of duplicates of three tree species. The second series was also composed of three duplicates, one of which was identical to a duplicate in the first batch. The results of this comparison were reported by de Wit (1973).

Signifficant differences between and within laboratories were observed in the analytical results reported for some samples. This communication is intended to point out possible reasons for variations in the results. It is not intended as a criticism of the analytical methods or precision of any laboratory.

Possible causes of minor error:

1. *Heterogeneity of the samples*

Since the samples were received finely ground and, apparently, well mixed, they should not have been heterogeneous.

2. *Method of determination*

Results may vary with the particular method of determination. However, if the same method is used in a particular laboratory for the analysis of duplicates, the results should be similar, within experimental error.

3. *Others*

If the results obtained in a particular laboratory on all samples are slightly higher (e.g., N: contributor // 16, K: contributor // 10, Mg: contributor // 1) or slightly lower (e.g., Fe: contributor // 17) than obtained in other laboratories, then a weighing or similar error exists. For example, the N results of contributor // 16 are consistently high probably because there was a positive error in weighing. It is quite possible that the standard acid used for titration in the Kjeldahl method (if that were used) was slightly higher in normality than actually found in the laboratory. Contamination in the laboratory may also cause minor errors.

Possible sources of major error:

1. *Dilution error*

If the results reported by one laboratory are some orders of magnitude lower or higher than those reported by other laboratories, there is most probably an error in calculating the dilution factor. For example, the Mn results reported by contributor // 3 for the duplicates of a sample are one-fifth of those reported by others. Similarly, the Al results reported by contributor // 7 are 10-15 times as high as those reported by any other

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contributor (Exception: Results of contributor // 17 also appear to be erroneous for some samples). An error in calculation of the dilution factor appears likely.

Similarly, if the result reported by a particular laboratory for a sample is some orders of magnitude higher or lower than that of the duplicate, there is probably an error in calculating a dilution factor. For example, Mn results for one set of duplicates have been reported by contributor // 17 to be 40 ppm and 390 ppm. On another set of duplicates, the same contributor reported values of 60 ppm and 610 ppm. The Na results by contributor // 8 are reported to be 34 and 12 ppm for duplicates. In these examples, there appears to be a dilution error.

2. *Instrument settings*

For the sample which was submitted in duplicate on two different dates, Mn results by contributor // 11 are shown to be "trace" for the duplicates received on the first date and 90 ppm for those received on the second date. If Mn was determined by atomic absorption spectrophotometry, it appears that the wave length setting of the monochromator might not have been "peaked".

3. *Completion of all steps of analysis*

If the Mn determinations in the example given above were done by colorimetry, it is quite possible that the analyst forgot to add the reagent responsible for color development.

Conclusion

Major and minor sources of error exist in quantitative analysis. Results of the most recent IUFRO comparison of methods for plant analysis indicate the need for greater awareness of these sources to attain the highest accuracy and precision.

References:

Goor, C.P. van, M. de Wit and J. van den Burg. 1971 International comparison of methods for soil and plant analysis. Report of activities in 1970. 38 p., appendices. Forest Research Station "De Dorschkamp", Wageningen, The Netherlands.

Wit, M. de. 1973. International methods for chemical analysis (report on activities 1971-1973) IUFRO Subject Group S 1.02, Working Party 3. 7 p., appendices. Forest Research Station "De Dorschkamp", Wageningen, The Netherlands.

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PREFACE

The third session of the IUFRO Executive Board was held in Canberra, Australia, in October 1973. This edition of IUFRO News summarizes the main items handled during the session.

This News also contains reports from some other IUFRO meetings, and a list of planned or proposed new meetings is included.

The IUFRO Secretariat in Vienna has recently distributed a questionnaire to all Member Organizations of the Union. According to a decision made by the Executive Board, the intention is to collect information concerning the individual members within all Member Organizations. This information is limited to a few items such as age, university degree, language knowledge and field of interest according to the research group classes within the divisional structure of the Union. The numbering system, used to identify the different research groups, is printed on the back side of the questionnaire.

In this issue of the IUFRO News (page 12) we have printed an abbreviated version of the questionnaire as an example of how to fill in the form.

The information received on the basis of the questionnaire will be computerized and stored at the Union's permanent Secretariat in Vienna. Any IUFRO officer may in the future get information from the Secretariat concerning names and addresses of scientists within his field of interest. This is one important way of facilitating productive contact between forestry scientists within the IUFRO family.

We hope that the leaders of the IUFRO Member Organizations will help by filling in the questionnaire, using one line per individual research officer within the organization. The questionnaire should be returned to the Secretariat in Vienna at your earliest convenience.

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Aas, Norway, August 20, 1974

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President IUFRO