SIMULTANEOUS DETERMINATION OF PROTEIN AND GLUCOSINOLATES IN FARMERS' OILSEED SAMPLES BY ELEMENTARY ANALYSIS.

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INTRODUCTION

In Sweden some 160 000 ha of rapeseed is grown annually. The farmers are individually paid not only for quantity but also for the quality of delivered seed. Traditionally the quality analysis have included impurities, water-, oil- and chlorophyll content. After the introduction of doublelow material a glucosinolate analysis of the meal was added and during the last couple of years also a protein analysis.

During harvest time a considerable amount of samples are sent to the analysing laboratories and to be able to produce the results of analysis within the stipulated time a method was developed at the Swedish Cereal Laboratory where the protein and the glucosinolates in the meal could be analysed simultaneously.

MATERIAL AND METHODS

123 rapeseed samples from 1986 harvest were chosen with varying protein and glucosinolate levels. The seeds were extracted and defatted with the Swedish tube method (Troëng, 1955). The resulting meal has a particle size of less than 250 µm. 3 - 5 mg of this meal was weighed into tin capsules and analysed in the NA1500 elementary analyser from Carlo Erba Instruments for nitrogen, carbon and sulphur. As a comparison nitrogen was also analysed by Kjeldahl determination and the total glucosinolates were determined by gas chromatography as silyl derivatives of glucose after hydrolysation by myrosinase (method unpublished).

RESULTS

The protein content of the rapeseed meal can be calculated from the nitrogen value with a factor and the sulphur value can be used for calculation of the glucosinolate content.

In figure 1 the nitrogen content determined by elementary analysis was plotted against the Kjeldahl values.

The sulphur value obtained from the elementary analysis was corrected for the amount of protein sulphur which is relatively constant in rapeseed (Uppström and Johansson, 1987). The corrected value of sulphur was plotted against the glucosinolate value in figure 2 (Johansson, 1988).

During the work with the elementary analyser it was found that the carbon content of well defatted rapeseed meal is relatively constant. Thus the carbon peak in the chromatogram can be used as an internal standard and the samples, except the calibration samples, do not have to be weighed. Figure 3 shows a plot of the sample weight against the weight calculated from the carbon peak of the analysis.

DISCUSSION

With the elementary analyser NA1500 from Carlo Erba Instruments it was possible to analyse a meal sample for nitrogen, carbon and sulphur in 8 minutes. The extraction method used for the oil content determination results in a fine meal easy to homogenise, that is suitable for the small sample amounts used in the elementary analyser. The fact that the carbon

peak can be used as an internal standard saves time in the sample preparation.

To adapt the method for routine purposes it was necessary to introduce the analysis as a step in the multisequential method for oil and chlorophyll determination used at the laboratory. (Troëng, 1955; Appelqvist, 1967; Johansson and Appelqvist, 1984). A defatting apparatus was constructed to fit the 16 steel tubes in the tube racks used for this work. With the apparatus it was possible to defat 1500 samples/day. The elementary analyser was equipped with an automatic sampler with 196 sample positions. A computer system was installed to handle the integration and calculation of the results from the elementary analyser.

CONCLUSION

In Sweden 50.000-60.000 oilseed samples have to be analysed every year within a short time after harvest. With the described method it is possible to meet the farmers' demands both for speed and accuracy. The NA1500 elementary analyser can be used either for nitrogen, carbon and sulphur analysis or only nitrogen and carbon for samples where the glucosinolate content is not wanted.

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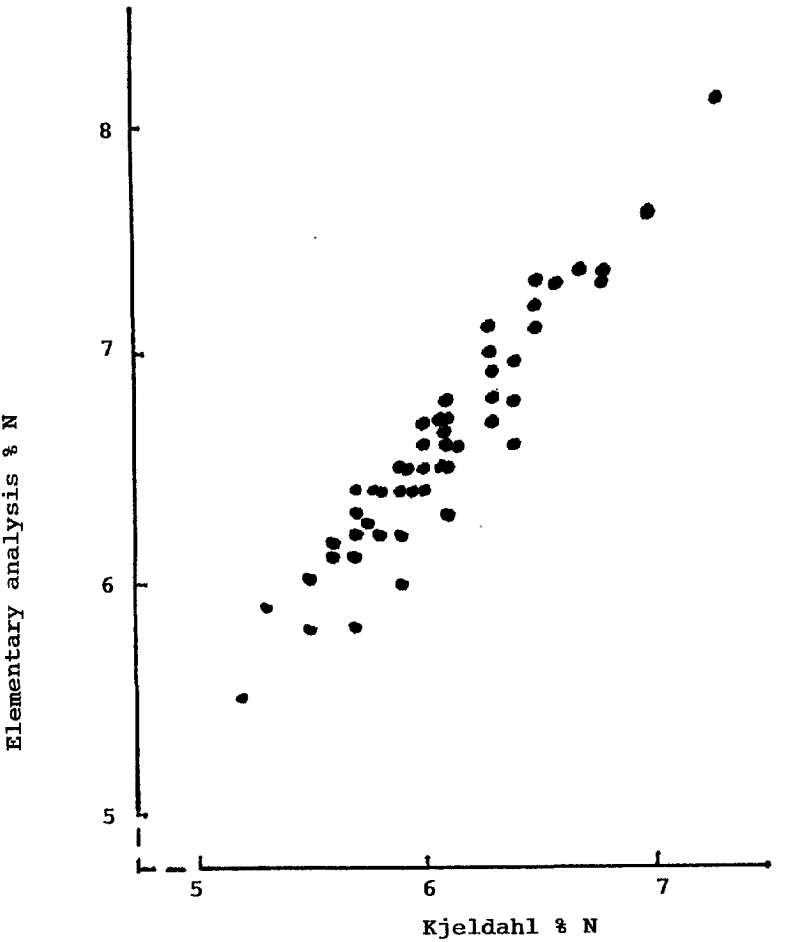

Figure 1. Nitrogen content in rapeseed meal analysed by Kjeldahl (300-400 mg) and elementary analyser (3-5 mg)

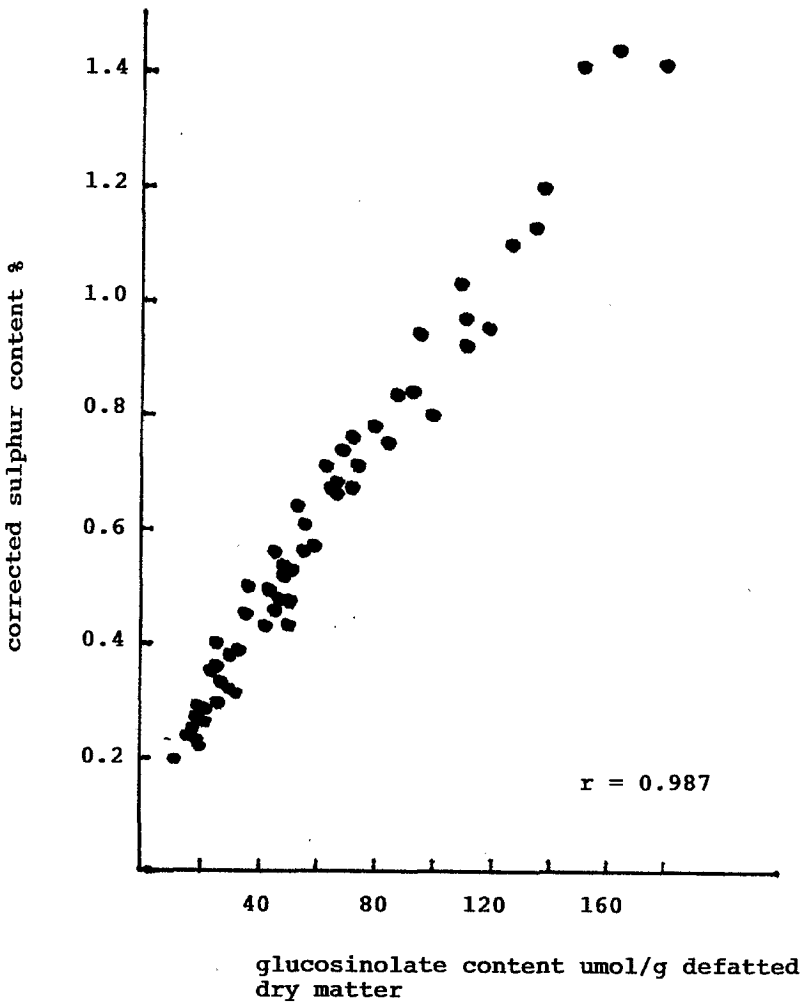

Figure 2. Comparison between the sulphur content in rapeseed meal corrected for protein sulphur analysed by elementary analyser and total glucosinolate content.

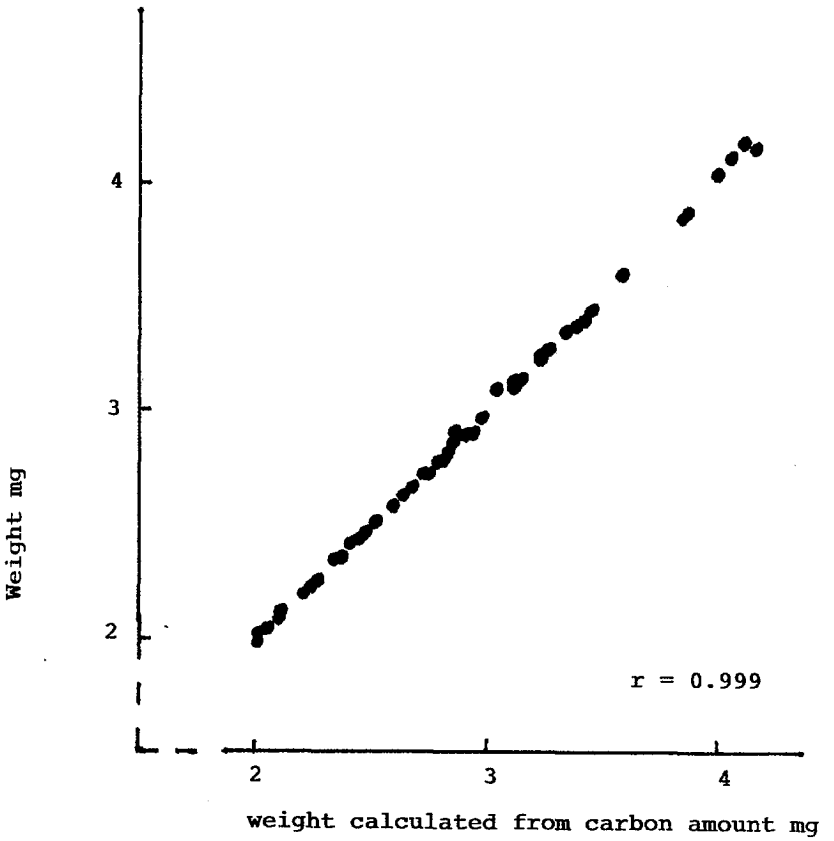

Figure 3. Line diagram of weight plotted against the calculated weight from the carbon, amount as analysed by elementary analyser