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Fertilizers — Sampling — Minimum mass of increment to be taken to be representative of the total sampling unit

Engrais — Échantillonnage — Masse minimale du prélèvement en cas de traitement de la totalité de l'unité d'échantillonnage à prélever

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ISO/TR 7553 was prepared by Technical Committee ISO/TC 134, *Fertilizers and soil conditioners.*

The reasons which led to the decision to publish this document in the form of a technical report type 3 are explained in the Introduction.

0 Introduction

Within the framework of its work on sampling, Technical Committee 134, *Fertilizers and soil conditioners*, has, through its sub-committee 2, carried out studies on the minimum mass which an increment may have in order to remain representative of the fertilizer sampled.

This work complements other standards for fertilizers, currently under preparation, particularly those which describe sampling plans for lots of various sizes, and those related to sample reduction.

This study, which is different from those usually published as International Standards, is intended to act as a complement to them, as a technical report (type 3) for the sampling of fertilizers.

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1 Scope and field of application

When sampling is carried out on a batch of fertilizer, an increment is taken from N units. Each of these increments may be taken either by means of partial sampling devices, if their validity (absence of any particular bias) is assured, or by treating the complete item with a suitable reduction device (absence of bias).

This Technical Report specifies, for the latter case, the extent of mass reduction beyond which the error in the representativity of the increment can no longer be ignored. It may also be used to establish the minimum mass of any intermediate increment during the treatment of the sample, up to analysis. Where partial sampling devices are used, this limiting mass can be much more important.

2 Basic theory

Taking into account the granular nature of solid fertilizers, the sampled mass cannot be reduced indefinitely without losing all representativity.

However, it is possible to relate the mass of the sample to a minimum error of representativity, as a function of the variability in composition of the product sampled and of its particle size distribution.

Emphasis should, however, be placed on the nature of the minimum limit value of this error to which can, in practice, be added large errors due to the variability of the increments, often associated with defective sampling devices (spears in particular).

It should also be noted that this error occurs at each reduction operation on the sample after its constitution. Particular attention is drawn to the fact that, in preparing the test portion from the laboratory sample, representativity can easily be lost if the masses sampled at a given point are insufficient with respect to particle size distribution and variability in composition or if they do not follow the rule of equiprobability of choice.

This concept is, in fact, empirically admissible because, in the case of determinations where grinding is allowed, such an operation is generally carried out before the test portion is taken.

Statistical studies now make it possible to calculate accurately a relation between these magnitudes. In cases where grinding is not possible (for example determination of particle size distribution), they also enable a relationship to be obtained between the mass of the test portion and the error of representativity.

Two types of fertilizer may be encountered:

a) Fertilizer in which all the particles are essentially of the same nature

Once the variability in analysis from one particle to another is known, it is possible to calculate statistically, on the basis of a normal distribution, the number of particles, and thus the minimum mass, required so as not to exceed a given uncertainty.

b) Fertilizer in which the particles are of a different nature (bulk blends)

Once the percentage of the least abundant constituent to be analysed is known, it is possible to calculate statistically, on the basis of a binomial distribution, the number of particles, and thus the minimum mass, required so as not to exceed a given uncertainty.

3 Fertilizers composed of particles of the same nature

The analyses vary continuously from particle to particle following a normal or an approximately normal distribution with a coefficient of variation generally between 10 % and 40 % (40 % in extreme cases with fertilizers obtained via an almost dry mixing stage).

Calculation on the basis of the theory of normal distributions indicates that, if the standard deviation for variations in particle analysis is called σ' and the desired precision at 95 % bilateral probability $2\sigma_\tau$, the mass of this increment is given, approximately, by the formula

$$C \times \frac{\pi}{6} \phi_m^3 \left(\frac{\sigma'}{\sigma_\tau}\right)^2 \varrho \times 10^{-3}$$

where

ϕ_m is the mean diameter of the particles as defined in the annex;

ϱ is the density of the particles;

$2\sigma_\tau$ corresponds to the overall error of judgement desired and is expressed in the same way as σ', for example as an absolute value;