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**Fertilizer Bulk Bag Sampling (1 mt)**

With the acceleration of global fertilizer trade, IFA’s diverse membership has experienced an increasing number of contractual disputes due to the use of different methods and procedures to sample and analyze international product shipments at different points in the supply chain. In a member-driven initiative, a broad-based international task force was formed to address this matter.

Accurate and representative sampling is a challenging operation that requires both knowledge of the product as well as the correct application of the sampling process. Sampling procedures must be applied in a strict manner by trained personnel with prior sampling experience. Moreover, a standardized approach must be adopted irrespective of the sampling location, shipment mass or volume, or commodity.

Sampling of material from packaged one ton bulk bags (super sacks / totes / IBC / big bags) is a common request. However, no applicable industry recognized standards exist for field sampling of solid fertilizer materials in bulk bag containers.

Fertilizer material in bulk bags is similar, on a smaller scale, to material in a wagon or storage bin.

A sampling procedure was developed involving insertion of a Double tube trier through the open top of the bulk bag, and angling the probe towards the bottom outside extremity of the bag, in a specified regular pattern disbursed throughout the bag’s geometry.

The method described follows the same principle as the IFA Recommendation for Fertilizer Bag Sampling (<50kg) with basic, minimum conditions that must be fulfilled to ensure that a sample of fertilizer fairly represents the lot of fertilizer from which the sample is taken. These minimum conditions are as follows:

A. Determine for what purpose the sample is required and determine the characteristics of the material, i.e., its estimated quality, maximum particle size, homogeneity, etc;
B. A sample must be of a sufficient mass or volume for the required analyses;
C. In case of lots or shipments of 10 bags or less, a sample shall consist of approximately equal portions (increments) drawn from each bag in the lot;
D. In the case of lots or shipments of 11 bags or more, a sample shall consist of approximately equal portions (increments) drawn from each bag of the square root of number of total bags;
E. Minimum requirement would be the sampling of any 10 bags in a lot or shipment.

For industry quality control purposes, a "lot" shall be represented by the quantity of a given product made during a specified time period, in storage at a single location, or shipped from a single production point.

Experience has demonstrated that sampling methods (and samples), all other conditions being equal, are more reliable whenever a larger number of (unbiased) increments are collected.

Conditions such as segregation, heterogeneity, stratification, contamination, etc. must be considered if bias is to be avoided and if sampling and sample preparation variance are to be minimized.

Sampling of blended materials may bring about additional challenges in ensuring proper sampling. The homogeneity of the blend, particularly sizing must be considered.
It should be noted that due care must be followed in utilizing proper sampling equipment/apparatus for the material being sampled and for the type of bags containing the material of interest. Studies have concluded that the double tube trier (spear) is the recommended apparatus for probe sampling; however, the dimensions of the trier have to be appropriate to the characteristics of the sample portion and to the particle size (minimum 3x particle size) of the fertilizer. Increments collected should be stored immediately in moisture-impervious containers (if moisture is a concern / specification), but always in a container capable of preserving the integrity of the collected increments.

This recommendation is based on best case scenario with product being that of a free flowing and penetrable state. Due to settling of material, non-penetrable product by use of recommended sample spear (trier) may require use of alternative equipment such as scoop or shovel to access and sample said material.

During operations where bags may be emptied, sampling may be conducted from the falling stream. A sample funnel system may be employed or where a funnel system is unavailable a sample cup may be utilized passing the sampler through the complete stream at uniform speed, such that the cup will collect approximately equal amounts of material during each pass.

Sampling personnel should utilize their training and expertise to determine any circumstance outside the standard scope that may have implications upon the sample taken.

Manual sampling of this type does not satisfy the minimum requirements for probability sampling, and as such should not be used to draw statistical inferences such as precision, standard error, or bias.

For more reliable method that provides probability samples, it is recommended whenever possible that sample increments be collected during the filling of said bags while material is in movement.

During any sampling operation, consideration must be given to conditions that help to minimize health and safety risks to personnel.

**Method Validation Study**

**Comparison study of Bag Probing Technique Compared to Fertilizer Stream Cutting Technique (Summary)**
(Kane 2006)

A sampling procedure was developed involving insertion of a Missouri D tube through the open top of the bulk bag, and angling the probe towards the bottom outside extremity of the bag, in a specified regular pattern disbursed throughout the bag’s geometry.

This procedure is compared to an existing validated AOACI procedure which involves passing a specially designed sampling cup through a free falling stream of fertilizer as it falls off the end of a transport conveyer belt, or falls from a discharge chute, in the process of moving material in a blending plant. A blending plant was located where it was physically possible to conduct both of these sampling procedures concurrently, as a large batch of fertilizer materials was blended, mixed, and processed through conveyer systems to fill bulk bags.

In this study three different NPK blends were produced and sampled by both techniques. Samples were analyzed by validated AOACI laboratory methods for nitrogen, phosphorus, and potassium, and analytical data from the two sampling procedures was statistically compared.
For all three blended products, there was no significant difference between results of the stream cut samples and the bulk bag probe samples, for N, P, and K data. In fact, the lowest probability at the 95% confidence level was about 0.45, with most probability values considerably higher. Under the conditions of this study, the stream cut and bulk bag sampling techniques give equivalent results.

**Bulk Bag Sampling**

![Figure 1. Double tube trier.](image1.png)

![Figure 2. Bag sampling technique.](image2.png)

![Figure 3. Transfer of core sample from Double tube trier into intermediate container.](image3.png)

*Note: A Double tube trier (Figure 1) with solid core pipe constructed of stainless steel or brass. Stainless steel is recommended for samples on which micronutrients are to be determined.*

**Bulk Bag Sampling Scheme**

![Figure 4. Single bag 12 increments.](image4.png)

![Figure 5. 2 bags 6 increments each.](image5.png)

![Figure 6. 3 or more bags 4 increments each](image6.png)

*Note: Insert the closed double tube trier starting from the top center of the bag, and angling the probe approximately 30 degrees to the mid point of the bottom edge of the bag (see Figure 4), then opening the trier inside the bag so that the product falls through the openings filling the trier. Then close the trier and remove from bag. If the lot consists of 3 or more bulk bags, then probe 4 times from each of the bags, dividing each bag into 4 equal quadrants. If only 2 bulk bags are available, probe 6 equal vertically divided segments in each bag. If only 1 bag is available, probe 12 equal vertically divided segments.*
Bulk Bag Sampling Illustration

**Figure 7.** Big bag cargo.

**Figure 8.** Collecting sample increment.

**Figure 9.** Collecting sample increment.

**Figure 10.** Collecting sample increment.

**Figure 11.** A double tube trier.

**Figure 12.** Double tube trier open position.

**References**


2. Peter F. Kane, Office of Indiana State Chemist, Purdue University, West Lafayette, IN. Paper Number 2006-17972 of the Purdue University Agricultural Experiment Station.