A/14/93
June 2014

Fertilizer Bag Sampling (≤ 50 kg)

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This recommendation and its background documents are available to the general public on the IFA web site (www.fertilizer.org), or through written request to the IFA Secretariat.

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1. Introduction

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.

2. Overview and evaluation of existing methods

Sampling of material from packaged bags is a common request. **Table 1** lists various industry sampling methods and procedures for bag sampling. Comparably, the methods listed follow the same principle 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.

3. Guidance for fertilizer bag sampling

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.

It should be noted that, while the basic sampling methods outlined are comparable in principle, 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 is the recommended apparatus for bag sampling. 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.

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.

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.

TABLE 1. FERTILIZER BAG SAMPLING – METHOD COMPARISON.

Standard	*Number of increments*	*Mass of increment and Bag Sizes*	*Frequency*	*Sampling place*	*Apparatus*	*Sample container*	*Sample Division*	*Remarks / Region in use*
T-4-114	For 10 bags or less, collect one increment from each bag. For more than 10 bags, collect an increment from a minimum of each of any 10 bags in the lot	2 kg to 4 kg for a composite sample only For bags up to 11 kg and larger, then, 11 kg	The number of increments or the frequency of increments is to be decided by the sampling scheme	Not defined	Single-tube, open trier with a diameter at least 2.0 cm, with a length of between 65 cm to 90 cm	For fertilizers without pesticides: use a standard laminated bag or large polyethylene sample bag. For fertilizers with pesticides, the sample should be placed into a metal container, i.e., a paint can	Not defined	Method used in Canada by the Canadian Food Inspection Agency
ISO 8633:1992; (Section 6.1 and 7.1) Simple sampling method for small lots of solid fertiliser	<10 bags – all bags 10 to 400 bags – 10 bags minimum >400 bags – 20 bags Above 100 bags – square root of the total number of bags present	Minimum mass of increment as per **ISO/TR 7553** No more than 50 kg bags. Anything higher should be treated as bulk	One increment from each selected bag.	Not defined	Flat-bottomed shovel or scoop with vertical sides. Spear can be used provided the spear can collect increments more than the minimum mass and is appropriate for the particle size of the material being sampled	Sealable, airtight container	Riffle, cone sample divider, automatic rotary sample divider (RSD) (provided the RSD does not segregate by particle size)	Internationally recognized
ISO 8634:1991; Sampling plan for the evaluation of a large delivery of solid fertilizer.	Not clearly identified	As per **ISO/TR 7553:1987** Can be used for bag sizes of 10 kg to 100 kg	One increment from each selected bag	Not defined	Same as **ISO 8633:1992** above	Clean, water tight, and sealable containers (which should be numbered accordingly , e.g.,1, 2, 3, etc.	Rotating sample divider (RSD), alternatively riffle divider, coning and quartering as per **ISO 7742**. For chemical/physical test portions sample should not be ground, as per **ISO 8358**	Internationally recognized **NOTE**: coning and quartering can lead to increased segregation and increased division variance (**ISO 18283:2006**, 8.3 Mixing)

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GOST 21560.0; Fertiliser mineral. Methods of sampling and preparation of samples Standard defines sampling from static places, as well (bags, trucks, stock piles, etc.)	Square root of the number of units to be sampled	Mass of spot sample should be no less than 500 g GOST does not specify the bag size	Two samples taken diagonally.	Not defined	Single Tube Trier.	Clean, plastic bag, which should be sealed	Rotating sample divider (RSD) or riffle divider, average sample 1 to 2.5 kg	Russia and other FSU countries
EC 2003/2003; dd. 21.11.2003; Fertiliser Directive	Square root of the total number of units available for sampling	Approximately equal mass from each unit For packaging up to 100 kg, sampling scheme will work. For packaging over 100 kg, recommendation is to sample whenever the material is moving	Part of the contents of each package should be removed prior to sampling	Not defined	Flat bottomed shovel with vertical sides, Sampling spear with long split or compartments. Spear should be appropriate for the characteristics of the sampled portion	Containers or packages shall be scaled and labelled	Final sample should be divided to 2 kg by mechanical divider or by quartering method	EU Countries **NOTE**: coning and quartering can lead to increased segregation and increased division variance (**ISO 18283:2006**, 8.3 Mixing)
AOAC 929.01; Sampling of Solid fertilisers	For lots > 10 bags, sample each 10 bags. For lots < 10 bags, take 10 cores, but at least one from each bag present	Not defined Bag size is not defined, but, for lots smaller than 10 lbs, the entire package is taken as an increment.	Lay the bag horizontally and remove the core diagonally from end to end	Not defined	Slotted single or double tube trier with a solid cone tip. The trier length should be the approximate length of the bag to be sampled	Airtight container	Riffle divider	North America.

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TFI, The Fertiliser Institute, Fertiliser sampling and analytical methods, 4th Edition The document defines sampling from static places, as well (bags, trucks, stock piles, etc.)	If the lot contains 10 or more bags, randomly select 10 and collect one core from each. If a lot contains less than 10 bags, collect one core from each bag	Not defined Bags size is the same as **AOAC 929.01**	Lay the bag horizontally and remove the core diagonally from end to end	Not defined	Slotted single or double tube trier. Stainless steel is required on samples on which micronutrients are required. Minimum dimensions are: Length – 63.5 cm Slot Length – 58.4 cm Slot Width – 1.3 cm Inner Diameter – 1.6 cm	Container 1 L, constructed of corrosion-resistant material with a moisture-proof barrier or fabricated from material that will not permit moisture to enter or leave a sample	Riffle dividers	North America
FAI, The Fertiliser (control) order 1985 (as amended upto June 2006)	Up to 2000 bags – 0.5 % of bags to be sampled. If this procedure cannot be followed, samples should be drawn in zig zag fashion on different layers	100 g – for straight micro nutrient fertilizers 50 g – for chelated micro-nutrients 400 g – for all other fertilizers Bag size is not defined	Bags to be sampled should be selected systematically (1, 2, 3, etc.) Sample probe to be inserted diagonally. If sample probe cannot be used, the contents should be emptied onto a clean surface and quartered.	Not clearly defined, but should not be exposed to sun or rain.	Sample probe (stainless steel or brass and single slotted) or scoop for cone and quartering	Clean, dry, and air-tight glass or hard polythene bottle with a screw top. Thick gauged polythene bag can also be used.	Cone and Quartering	India **NOTE**: coning and quartering can lead to increased segregation and increased division variance (**ISO 18283:2006**, 8.3 Mixing)

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AFPC-V1-1K; Association of Fertilizer & Phosphate Chemists method VI-1K, Method for Bagged Goods.	If a lot contains 10 bags or more, randomly select 10 bags. If a lot contains less than 10 bags, sample each bag	Not defined. Bag size is not defined.	Randomly sampled. Roll bag prior to sampling to ensure free flowing product. Sample diagonally corner to corner	Not defined	Solid core pipe constructed of stainless steel. Minimum dimensions are 25 in (Length) X 23 in (Slot Length) X ¾ in (Slot Width)	Moisture-proof container with complete identification	Not defined	USA
EN 1482-1:2007	If < 5 bags – one increment per bag If 4 < n bags < 11 bags – 4 bags are sampled If 10 < n bags < 401 – the entire number above the square root of the number of bags >400 – square root of the number of bags	Minimum 250 g, for blends, 500 g minimum Bag size is defined as no more than 50 kg. Anything over this amount should be treated as an IBC – Intermediate Bulk Container	Random samples of bags to be marked prior to sampling beginning. One increment per sampled bag	Not defined	Shovel or sampling spear	Glass or plastic containers. Also acceptable to use other containers as long as the integrity of the sample is maintained. Containers must be airtight.	Rotating or riffle divider, coning and quartering	European Standard. **NOTE**: coning and quartering can lead to increased segregation and increased division variance (**ISO 18283:2006**, 8.3 Mixing)

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SN/T 0736.1 – 1997 Method of inspection for import and export fertilisers	Basic Batch Number is 50,000 bags	30 to 50 g per sampled bag Bag size is not defined	Sample random bags – no less than 100 bags, but according to the formula given	Unloading or Loading Process	Stainless steel stick – 550 mm X 10 mm. Opening should be from 10 mm to 50 mm	bottles or bags	Coning and quartering or dichotomy, 2 kg (§3.4.2)	Chinese Standard **NOTE**: coning and quartering can lead to increased segregation and increased division variance (**ISO 18283:2006**, 8.3 Mixing)

TFI Bag Sampling Scheme

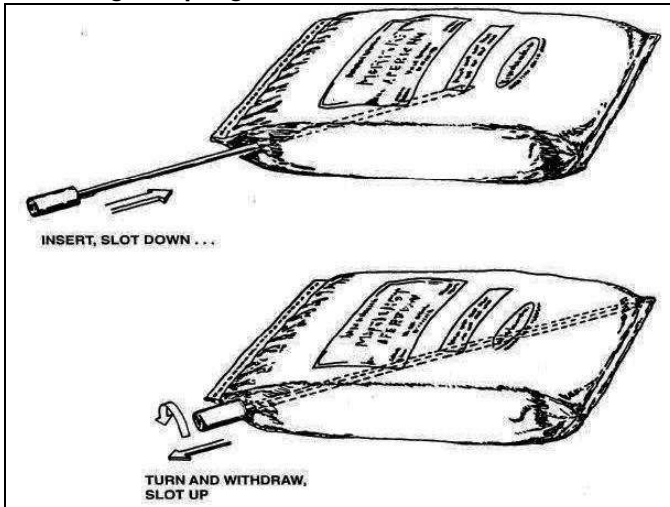

Figure 1. *Bag sampling technique – Single tube (bag must be flat and horizontal).*

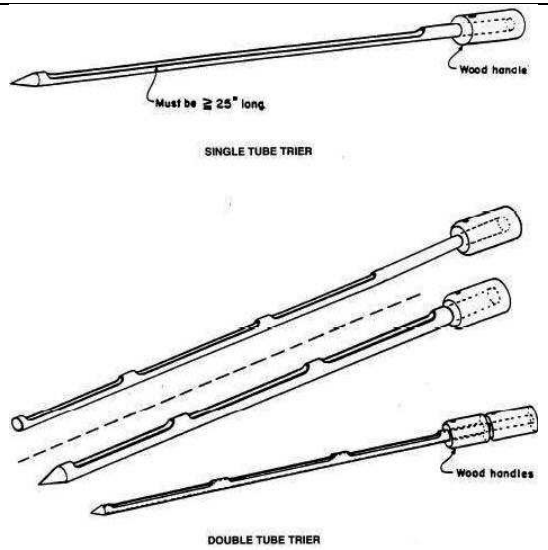

Figure 2. *Single and double tube trier.*

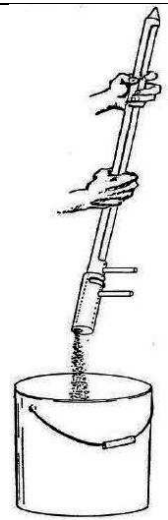

Figure 3. *Transfer of core sample from Missouri "D" tube into intermediate container.*

*A slotted single or double tube trier (**Figure02**) with solid core pipe constructed of stainless steel or brass. Stainless steel is recommended for samples on which micronutrients are to be determined.*

Sampling Exercise Was Conducted utilizing various Sampling Equipment/Apparatus

Table 2. Dimensions.

Sampler	Length (mm)	Outside Diameter (mm)	Inner Diameter (mm)	Compartments	Dimensions (mm)
SPL-01	420 / 300	15	13	1	200 X 13
SPL-02	800	24	22	1	100 x 12
SPL-03	1500	40	35	6	104 X 22

Table 3. Results of Sampling Exercise.

IFA Sampling Exercise								
	AN				NPK 16-16-16			
SAMPLE IDENTIFICATION	SPL-01	SPL-02	SPL-03	Standard	SPL-01	SPL-02	SPL-03	Standard
% < 1 mm	1,9	2,6	3,4	3,9	0.0	0.2	0.2	0.1
% 1-2 mm	5,6	6,4	7,3	7,5	7.5	12.6	12.8	11.5
% 2-3 mm	77,2	77,8	77,2	76,0	63.5	63.9	65.9	67.3
% 3-4 mm	15,0	12,8	11,8	12,2	25.8	20.5	19.1	19.3
% > 4 mm	0,3	0,4	0,3	0,4	3.2	2.8	2.0	1.8
% 1-4 mm	97.8	97.0	96.3	95.7	96.8	97.0	97.8	98.1

Figure 4. *A sampling spear (SPL-01).*

Figure 5. *A single tube trier (SPL-02).*

Figure 6. *A double tube trier (SPL-03).*

Figure 7. *Ammonium nitrate in bag.*

Figure 8. *Bagged fertilizer.*

Figure 9. *Sampling diagonally across a horizontal bag; single tube trier.*

Figure 10. *Collecting an increment; sampling spear.*

Figure 11. *Placing an increment into a container.*

Figure 12. *Collecting an increment; single tube trier.*

Figure 13. *Collecting an increment; single tube trier.*

Figure 14. *Collecting an increment; double tube trier.*

Figure 15. *Collecting an increment; double tube trier.*

Figure 16. *Dividing a sample with an enclosed riffle with a feed chute and fed by a feed pan that is as wide as the riffle.*

Figure 17. *A final sample.*