

# CALIFORNIA CROP IMPROVEMENT ASSOCIATION

## SEED SAMPLER CERTIFICATION PROGRAM

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Third Draft



## Handbook of Seed Sampling Procedures



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## INTRODUCTION

California Crop Improvement Association (CCIA) is the official agronomic and vegetable seed certifying agency in California as recognized by the California Seed Law. The purpose of the CCIA is to provide seed certification service, a voluntary quality assurance program for the maintenance and increase of agronomic and vegetable crop seed. Each variety that is entered into this program has been evaluated for its distinctness, stability and unique characteristics such as pest resistance, adaptation, uniformity, quality, and economic yield. Seed production is closely monitored by the CCIA to prevent out-crossing, weed, other crop and disease contamination that may negatively affect seed quality. California certified seed is produced under strict standards established by the CCIA Board of Directors, the Association of Official Seed Certifying Agencies (AOSCA) and the Organization for Economic Cooperation and Development (OECD).

The CCIA works closely with seed growers as partners in the seed industry to assist in the production of high quality certified seed. The mission of the CCIA is to engage in activities that promote the production, distribution and use of superior quality seed. Crop varieties today have tremendously complex genotypes and advancements in genetics are occurring at rates unimagined before. Use of superior quality certified seed assures that the full genetic potential of a variety is uncompromised and is available for the production of the highest quality crop yields. The assurance of genetic purity and quality contributes great value to seed leading to greater profits for both the grower and conditioner.

Seed certification standards have been established by the CCIA for all crops that are certified in California. The CCIA ensures that its standards meet or exceed those of AOSCA and OECD. Seed testing is the basis of the determination of seed quality that should meet or exceed these quality standards. Quality characteristics of seed include trueness to variety; genetic purity, i.e. lack of other crop seeds, weed seeds, inert matter, insect damage and seed borne diseases; and germination, i.e. capability of seed to produce a normal plant under favorable conditions. Seed laboratories provide quality seed testing services which form the basis for seed certification. However, in the final analysis, no matter how high the quality of seed tests are, more accurate estimations of seed lot quality are only possible if the samples tested are representative of the seed lots. The ***purpose*** of the Seed Sampler Certification Program (SSCP) at the CCIA is to ensure that representative samples are collected according to established procedures from all lots that are submitted for certification by various conditioners. Such a sampling procedure would ensure that the results from the various laboratories are accurate and would ensure that the CCIA meets customer needs as well as State and Federal statutory and regulatory requirements more effectively and efficiently.

## SEED SAMPLER CERTIFICATION PROGRAM (SSCP)

The CCIA has an elaborate Field Inspection Program and an elaborate Seed Certification Program that is backpacked with the Seed Laboratory Recognition Program. But seed sampling is done either by staff at the Agricultural Commissioner or at the CCIA's Accredited Seed Conditioners. There is a need to have these samplers accredited to be in compliance with USDA/OECD requirements. Despite USDA's efforts to provide accreditation for seed samplers through their Accredited Seed Sampling Program (ASSP) under the Process Verified Program (PVP) within the Agricultural Marketing Service, there remains to be a general lack of accredited samplers nationwide in general and in California in particular. The Association of American Seed Control Officials (AASCO) has developed a Seed Sampler Trainer Accreditation Program to accredit seed sampler trainers. The AASCO Seed Sampler Trainer Program's training is based on its *Handbook on Seed Sampling* which presents sampling methods that are in accord with the Association of Official Seed Analysts' (AOSA) *Rules for Testing Seeds*. The methods may also be recognized by the Canadian Food Inspection Agency (CFIA). With an accredited sampler trainer the CCIA has established a Seed Sampler Certification Program (SSCP) under AASCO's oversight to train and accredit seed samplers in California.

Sampling seed lots for testing is the responsibility of a sampler. The accuracy of the sampling performed and the information submitted by the sampler are vital to the integrity of any seed tests and eventual labeling of any seed lot. It is important that a random sample be taken in accordance with approved procedures to ensure that it is representative of the seed lot. Proper sampling procedures in obtaining the sample are the basis for the result to accurately reflect the quality of the seed lot. It is essential that the sample be collected with care and in accordance with established procedures for proper seed sampling. Likewise, in reducing the composite sample, every effort must be made to obtain a representative submitted sample.

### Objective of Seed Sampler Certification Program:

The Federal Seed Act and State Seed Laws regulate the seed market by ensuring that seed vendors offer seed that is in compliance with standards for sale. Compliance with these laws is determined via truth-in-labeling with information from a Laboratory Report of Analysis (LROA) that is submitted by the laboratory after it completes a seed test done under AOSA's oversight. But this is a result of a seed test done on a sample of seed that represents a large seed lot. Obtaining a representative seed sample of a size suitable for the appropriate tests connects the seed sample test in the laboratory with the seed lot for reliable labeling. The **objective** of the SSCP is to promote the use of acceptable sampling procedures to improve seed lot quality estimation and to enhance uniformity and consistency of seed sampling.

**SCOPE:**

The Association of American Seed Control Officials (AASCO) has developed a Seed Sampler Trainer Accreditation Program to accredit seed sampler trainers. The AASCO Seed Sampler Trainer Program's training is based on its *Handbook on Seed Sampling* which presents sampling methods that are in accord with the Association of Official Seed Analysts' *Rules for Testing Seeds*. The AASCO *Handbook on Seed Sampling* is also the primary reference for this Sampler Certification Program Training. The methods may also be recognized by the Canadian Food Inspection Agency (CFIA). This *Handbook on Seed Sampling Procedures* has been prepared by the California Crop Improvement Association (CCIA) Seed Sampler Certification Program (SSCP) to augment AASCO's *Handbook on Seed Sampling* for purposes of the Sampler Training Workshop. The manual will also serve as a reference for this Seed Sampler Certification Program Training, evaluation and audit of certified samplers.

**REFERENCE DOCUMENTS:**

1. Association of American Seed Control Officials (AASCO): *Handbook on Seed Sampling*. [www.seedcontrol.org/seed\\_sampling\\_handbook.html](http://www.seedcontrol.org/seed_sampling_handbook.html)
2. Association of Official Seed Analysts (AOSA): *Rules for Testing Seeds*. [www.aosaseed.com](http://www.aosaseed.com)
3. Association of Official Seed Certifying Agencies (AOSCA): *Operational Procedures*. [www.aosca.org/about.html](http://www.aosca.org/about.html)
4. California Crop Improvement Association (CCIA): [www.ccia.ucdavis.edu/index.htm](http://www.ccia.ucdavis.edu/index.htm)
5. California Department of Food and Agriculture (CDFA): *California Seed Law* <http://www.cdfa.ca.gov/phpps/pe/nursery/pdfs/SeedLaw2010.pdf>
6. Canadian Food Inspection Agency (CFIA): *Canadian Methods and Procedures for Testing Seed*. 2007. [www.aosaseed.com/docs/Canadian\\_M&P\\_2011.pdf](http://www.aosaseed.com/docs/Canadian_M&P_2011.pdf)
7. Canadian Food Inspection Agency (CFIA): *Quality System Procedure: Official Seed Sampler Certification*. <http://www.inspection.gc.ca/plants/seeds/inspection-procedures/seed-sampler/eng/1347777009194/1347777446885>
8. International Seed Testing Association (ISTA): *International Rules for Seed Testing*. 2004. [www.seedtest.org/en/home.html](http://www.seedtest.org/en/home.html)
9. OECD *Seed Scheme* Appendix 8. [www.oecd.org/tad/seed](http://www.oecd.org/tad/seed)
10. US OECD *Procedures Guide*. [www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELDEV3024595](http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELDEV3024595)
11. USDA *Federal Seed Act*. [www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRD3317283](http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRD3317283)
12. USDA Seed Analysis Certificate (SAC) *Seed Sampling Guidelines for the Seed Regulatory and Testing Branch (SRTB)*. 2006. Revised January 2011.

**DEFINITIONS:**

**AASCO** – Association of American Seed Control Officials, accredits seed sampler trainers and publishes the *Handbook on Seed Sampling*;

**Certified Sampler** – A sampler that has been trained, evaluated and certified by the CCIA Seed Sampler Accreditation Program to collect samples for AOSA laboratories under AASCO's oversight as required by USDA and OECD;

**Amenity seed** – seeds of grasses and small seeded legumes that are not used for fodder/forage production purposes;

**AOSA** – Association of Official Seed Analysts, publishes *AOSA Rules for Testing Seeds*;

**Authorized Sampler** – A sampler that has been trained and has the authority to collect samples for ISTA-accredited laboratories or for the USDA laboratory;

**Lot Blend** – A blend of different fields/lots of the same variety through a thorough blending process to ensure homogeneity of the seed lot;

**Bulk Seed** – Loose conditioned seed in bins and trucks;

**CFIA** – Canada Food Inspection Agency, publishes *CFIA Canadian Methods and Procedures for Testing Seed*;

**Composite Sample** – Sample formed by combining and mixing all the primary samples taken from the seed lot;

**Direct Sealing** – When a container is closed with a specific seal that cannot be opened or tampered with without destroying the seal;

**Homogeneous Lot** – A seed lot that is of adequately uniform composition in its entirety;

**Herbage Seed** – Seed to produce plants grown for fodder/forage, particularly grass species;

**Heterogeneous Lot** – A seed lot that is not of adequately uniform composition in its entirety;

**Indirect Sealing** – Container does not need a specific seal and can be sealed through a stitched label or by stitching;

**ISTA** – International Seed Testing Association, publishes *ISTA International Rules for Seed Testing*, authorizes the issuance of the Orange, Blue and Green certificates, and accredits seed laboratories;

**Label** – All tags or other devices attached to or written, stamped or printed on any container or accompanying any lot of seed in bulk stating all required seed lot information;

**Laboratory Report of Analysis (LROA)** – An official document of results of a seed test for a seed lot issued by a seed laboratory under *AOSA Rules for Testing Seed*;

**Lot** – A definite quantity of seed identified by a lot number, every portion or bag of which is uniform, within permitted tolerances, for factors which appear in the labeling – USDA definition;

**Lot Number/Designation** (unique identifier) – Set of numbers, letters, symbols or their combination that singly or combined uniquely identifies the lot;

**Milking** – Any form of agitation, while the Nobbe trier remains in the same overall position in the container, shall not be done;

**Mini-Bulk Seed** – Conditioned seed in woven bags (i.e. forty bushel), large plastic boxes (buck horn boxes), wood or metal boxes (mini totes), commonly moved with fork lifts;

**Official Seed Sampler** – A sampler, who is trained, evaluated and certified or recognized as being competent in seed sampling by the CDFA, USDA and AASCO to take official samples;

**Primary Sample** – A primary sample is a small portion taken from a seed lot during one sampling action;

**Recognized Sampler** – A sampler from an agency with a sampling Quality Management System and work job instructions and is recognized by an ISTA-accredited laboratory as competent to collect samples when sampling in accordance with ISTA *International Rules for Seed Testing*;

**Retained Sample** – A sample that represents the seed lot and is drawn by appropriate sampling methods, clearly identified as to kind, variety and lot number and stored in a manner that retains sample integrity;

**Sealed (lot and/or Sample)** – The container(s) of seed that are closed in such a manner that the container(s) cannot be opened to gain access to the seed without either destroying the seal or leaving evidence of tampering;

**Seed Conditioner** – Any person who cleans, scarifies or blends seed to obtain uniform quality, or who conducts operations that change the purity, germination or identity of a seed lot;

**Seed Sample Container** – Those types of containers that ensure that the integrity of the sample is maintained;

**Sub-Sample** – A portion of the composite sample obtained by mixing and reducing the composite sample by an approved method. Example: submitted sample;

**Submitted Sample** – A sample submitted to a seed testing laboratory. It may comprise either the whole or a sub-sample of the composite sample;

**Variety Blend** – A seed lot that is a thorough mixture of different varieties by an established amount of composition of the varieties and known by a distinct blend name;

**Working Sample** – A sub-sample taken in the laboratory from the submitted sample on which a quality test is made;



**PROGRAM JUSTIFICATION:**

The CCIA closed its in-house seed laboratory in 2003. Since then all laboratory tests are conducted by various public and private seed laboratories across the nation including Canada under the AOSA *Rules for Testing Seeds* as required for certification purposes. Five years after closure of the in-house seed laboratory, the CCIA decided to conduct a major review of the seed testing and certification activities through a check-test assessment using 10% of the seed lots certified in 2008. These samples were subjected to purity and germination testing at the CCIA according to AOSA *Rules for Testing Seeds* to verify the results stated by various seed laboratories on the Laboratory Reports of Analysis (LROAs) that the conditioners originally submitted to the CCIA for certification of their seed lots.

Fig. 1 shows the results of the check-test assessment. About 20% of the conditioners whose lots were queried in the 10% requirement did not submit any samples because they had not retained any. Over 50% of the problem issues with retained samples that were sent by those conditioners that submitted them related to sampling problems. Over 40% of the seed tests had been conducted on treated seed. This had been done to fulfill OECD requirements but it contravened AOSA *Rules for Testing Seed*. AOSCA is currently reviewing the requirements for untreated versus treated seed sampling and testing and will address it accordingly with AOSA. Other issues relating to non-compliance with seed sampling procedures were with lot size and sample size requirements.

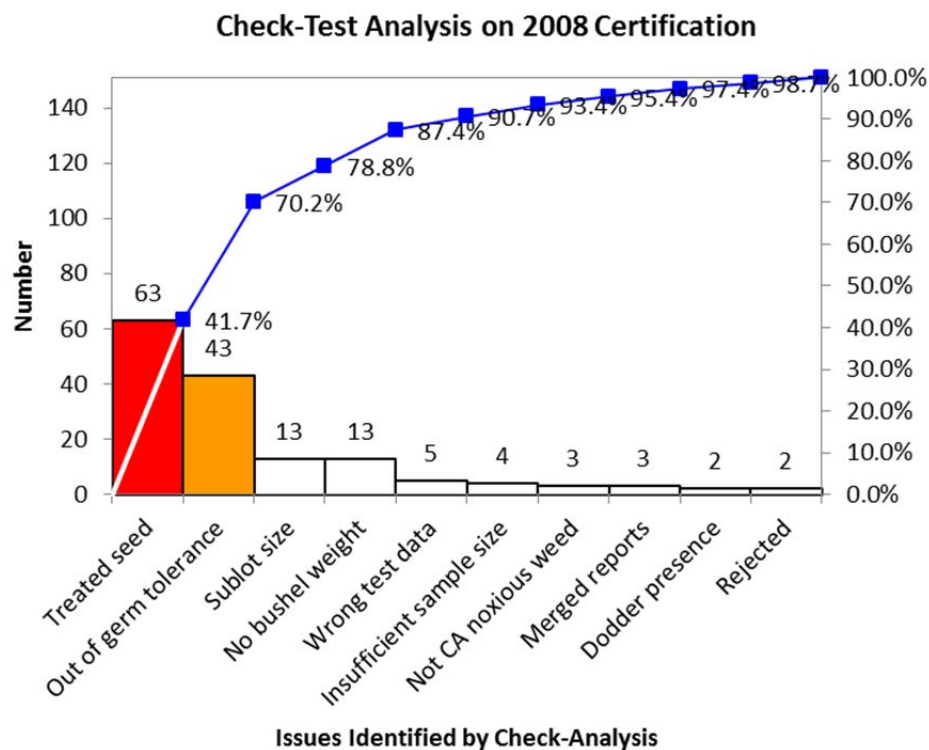


Fig.1. Non-conformance issues with seed sampling and testing in California



**REPRESENTATIVE SEED SAMPLE:**

The USDA's Federal Seed Act regulates all seed offered for interstate shipment and sale in the United States via truth-in-labeling. Reliable labeling may only be achieved if a seed test conducted by a seed laboratory connects with the seed lot. This can only be attained if the seed test was conducted on a sample that adequately represents the seed lot. The Act defines a seed lot as 'a definite quantity of seed identified by a lot number, every portion or bag of which is uniform, within permitted tolerances, for the factors which appear in the labeling.' The factors that appear on the label, and should be uniform within the entire seed lot, include pure seed, inert matter, other crop, weed seed and germination percentage. The components of a seed lot have an intrinsically acceptable variability and so tolerance is permitted for labeling purposes. To attain such uniformity the seed lot is expected to be effectively mixed for homogeneity. An extremely large seed lot may not be effectively mixed to ensure uniformity for the factors above within accepted tolerances. Therefore, seed lots should be such that they can be effectively mixed to assure such uniformity. The maximum size of the seed lot is expected to vary according to seed kinds and associated trade practices. State certification standards may be a good reference source for guidelines on maximum seed lot size. The Association of American Seed Control Officials (AASCO) has recommended maximum seed lot sizes (Appendix 5).

The underlying assumption in representative seed sampling is the fact that every unit in a seed lot has an equal chance of being sampled. Therefore, when sampling a seed lot, the sampler should check for signs of non-conformity like different types and/or sizes of containers, variations in marks and labels or mixed lot numbers. During sampling, the sampler should look for differences in seed kinds, color, shape, size and treatment as well as levels of impurities. Any such inconsistencies may alert the sampler that the seed lot may not be uniform and a sample drawn would not be representative for testing. And to reliably provide the seed laboratory with a representative sample, standard sampling methods must be applied with precision. Samplers should therefore follow the following guidelines: a) use appropriate sampling equipment and precisely follow procedures; b) take equal portions for each primary sample; c) take primary samples at random throughout the seed lot; d) obtain at least a minimum number of primary samples; e) access the entire seed lot.

After the sample is obtained it is necessary to accurately maintain its identity with the seed lot. It is also required that contamination of the sample be prevented by any means necessary. Accurate and thorough record keeping is another essential aspect of the sampling procedure to connect the seed lot with the sample and the laboratory report. At a minimum, a sample report, seed inspector report or seed sample form, should accompany the sample. It should show the seed kind, variety, lot number, lot size, number and size of containers, seed treatment (if any), the name and address where sampled, number of containers sampled, sampler's name and date sampled. It is always necessary for the sampler to keep a copy of the sampling report.

**PREPARATION FOR SAMPLING:**

Sampling should be planned in a reasonable time frame from the time of the request. Scheduling should take into account specific test requirements, such as moisture testing, that need to be initiated as soon as possible following sample collection. Seed lot and sample information needs to be collected prior to the physical collection of samples. A Seed Inspector Report (e.g. Appendix 6) will assist the sampler in attaining needed information to correctly sample the seed lot and complete a Sample Report.

The sampler shall:

- Communicate with the conditioner about the number of seed lots to be sampled and their location;
- Ensure that the seed lot is accessible for sampling. The sampler must exercise due diligence with respect to safety when sampling;
- Refuse to sample when a seed lot is:
  - Not labeled;
  - To be treated later;
  - Labeled for further conditioning;
  - Being sampled for an ISTA Orange Certificate unless sampler is authorized;
- Verify:
  - The crop kind for sampling
  - That the lot and all containers are labeled with the same unique lot designation/number;
  - That all containers are labeled with kind, variety if applicable, lot number, weight of the container and packer. Where tags are affixed to a lot the sampler should ensure that the information on the tag corresponds to all documentation; the size of the seed lot to determine the sampling intensity.
- Consult documentation related to the seed lot to verify lot size and identification (pedigree) seed declarations, blending records and certificates of analysis.

**Lot Size**

The AOSA *Rules for Testing Seed* have no established maximum lot sizes. However, AASCO *Handbook on Seed Sampling* has recommended maximum lot sizes (Appendix 5). Please inquire with the CCIA as to any allowable lot sizes.

## SAMPLING EQUIPMENT:

Proper seed sampling can only be performed if a sampler uses appropriate equipment. The types of equipment used in seed sampling include triers or probes, containers, dividers, balances and protective equipment (Appendix 1). There are two types of triers, viz: sleeve triers and Nobbe triers. And there are two types of sleeve triers, viz: partitioned and non-partitioned sleeve triers. **Sleeve triers** consist of an inner tube which fits loosely inside an outer tube but tightly enough so that seed impurities do not slip between them. The outer tube has a solid pointed end. Both tubes have slots cut into their walls so that the cavity of the inner tube can be opened and closed by twisting the tubes against each other. The difference in use between the two types of sleeve triers is that the non-partitioned trier can only be used horizontally whereas the partitioned trier can be used both horizontally and vertically. The minimum inside diameter should be about 25mm for all species.



Sleeve trier



Nobbe triers



Thief trier

The **Nobbe trier**, on the other hand, is a pointed tube with an opening near the pointed end. Seed passes through the tube and is collected in a container. The minimum internal diameter of the Nobbe trier is about 10mm for clovers, alfalfa and similar seeds, about 14mm for cereals and about 20mm for corn. The **thief trier** *is not approved* by AOSA for seed sampling.

The submitted sample is obtained by mixing and reducing the composite sample to an appropriate size by using the **Riffle**, the **Gamet** or the **Boerner** dividers shown below. The composite sample can be submitted to the seed testing laboratory if it is of appropriate size or if it is difficult to mix and reduce the composite sample properly under warehouse conditions.



Riffle



Gamet



Boerner

**CHOICE OF TRIER:**

The choice of an appropriate trier size is predicated by size of seed and the width of the trier slot. An appropriate trier is that whose width of slot is twice the size of the seed (Appendix 2). At no time is it permissible to use a trier that is smaller than the approved trier for the species being sampled. A good indication of an improperly sized trier would be when seeds do not readily flow out of the trier following sampling. Small-seeded crop kinds like clovers, alfalfa, rape and others of similar size must only be sampled using triers with a minimum slot width of  $\frac{1}{4}$ ". Medium-seeded crop kinds like cereals, rice, sorghum and others of similar size must only be sampled using triers with a minimum slot width of  $\frac{1}{2}$ ". Large-seeded crop kinds like sunflower, corn, cotton including large legumes like beans must only be sampled using triers with a minimum slot width of  $\frac{3}{4}$ ". Very chaffy grasses must only be hand sampled.

In addition, an appropriate trier to use for seed sampling is further predicated by specific crop kinds and the type of container in which the seed is packaged. Suggested trier selections are given in Appendix 3. Triers vary in length and outside diameter with varying slot sizes that may be appropriate for many sampling situations whether the different crop kinds described above are in bags or in bulk. Sleeve triers can be used if the seed is either in bags or in bulk. Nobbe triers can only be used for sampling seed in bags. In some instances, either a Nobbe or a sleeve trier may be appropriate if seed is in bags. Whereas a Nobbe trier with  $\frac{1}{2}$ " slot size would be appropriate for both small-seeded and medium-seeded crop kinds, a sleeve trier with a  $\frac{5}{16}$ " slot size is appropriate for small-seeded crop kinds and that with a  $\frac{1}{2}$ " slot size is appropriate for medium-seeded crop kinds. The large-seeded crop kinds may only be sampled by a sleeve trier.

**SAMPLING PROCEDURES:**

Before sampling the lot, the appropriate method for sampling based on the crop kind and the packaging of the seed must be selected. The goal is to have primary samples of approximately equal size to be taken from each container sampled or from each location when sampled in bulk situation. The instruments being used should not damage the seed or select according to seed size, shape, density, chaffiness or any other quality trait. Each primary sample is obtained by passing the sampling equipment through the seed once. Each pass of the sampling equipment into part of a seed lot is one (1) primary sample. The containers for sampling are selected randomly based on the minimum number of primary samples required to obtain a representative sample of the lot. When seed is in bulk or large containers, the primary samples shall be drawn from random positions and depths. Seed may be sampled as it enters the containers, provided that the instrument uniformly samples the cross section of the seed stream and seed entering the instrument do not bounce out again. The instrument may be operated either manually or automatically. The intervals between taking samples should be constant but may also vary randomly. When planning to take a sample, make sure all bags in the lot are readily accessible. If not, request assistance to have the seed moved. Prior to sampling, ensure that all sampling equipment is properly cleaned to avoid contamination.

All equipment used for sampling must be thoroughly cleaned before each use, and free from all extraneous matter including crop and weed seed; disease bodies or spores; any seed parts, chaff, dust and inert foreign bodies; and/or chemical residues such as seed treatments. Triers with residual seed that contains genes with novel traits could cause cross contamination of other seed lots. The container where the sample is placed as it is drawn must be thoroughly cleaned at the beginning of the sampling procedure and following each sampling operation.

#### **A. TRIER SAMPLING:**

When sampling containers, all positions inside the container must be accessible. For free-flowing seed in bags, the sampler must use an approved trier long enough to sample all portions of the bag. Non-free-flowing seed, such as certain grass seed, uncleaned seed, or screenings which are difficult to sample with a trier, may be sampled by thrusting the hand into the bulk and withdrawing representative portions.

##### **Sleeve Trier**

This type of trier is suitable for sampling seed in open bags, large containers or in bulk. There is no possibility of varying the amount of seed obtained from the inner and outer part of the container by adjusting the speed with which the trier is withdrawn. The trier must always be long enough to sample all portions of the container. When sampling the containers vertically, the trier must reach the bottom of the bags. The sleeve trier will obtain a constant amount of seed even if the speed with which the trier is withdrawn changes. The trier must always be long enough to sample all portions of the container. When sampling containers vertically, the trier must reach the bottom of the bags.

The sleeve trier draws the same size of sample in each sampling action. This type of trier may be more suitable for drawing samples from the bottom of containers than a Nobbe trier. The contents of the entire tube represent one primary sample. Triers must not be inserted through labels or printed labeling on bags. Care must be taken when closing the openings of the trier as there is a risk of damaging the seed trapped between the edges of the slots. The risk of damaging the seed can be reduced by slowly closing the openings to the point when resistance is felt. Care must be taken to ensure that all the openings in both the inner and outer tubes are clean to prevent contamination from sample to sample. The partitioned sleeve trier can be used vertically and in both open and closed penetrable containers.

Start at the bottom when sampling stacked containers. Use caution to prevent mechanical damage to the seed when inserting the trier into the container and when closing double-sleeved triers. Follow all safety precautions and use appropriate safety equipment. Care should be taken not to insert the trier through tags or labels on bags or unduly tear the container during insertion. The surface of the container must be cleaned of any debris to prevent possible contamination of the sample. The trier should be inserted diagonally from corner to corner. Whenever possible, insert the trier at a point where the seed exerts the least pressure on the container. Be careful not

to push the trier through the opposite side when probing the width of a bag. Care should also be exercised in closing holes made by a sampling instrument. One method for closing holes in loosely woven cloth bags is by stroking the point of a probe or trier across the opening in several directions. Holes in tightly woven cloth bags and paper or polyethylene bags may be closed with a pressure-sensitive tape. Always remove dust from the area before applying patching tape. So that patched holes on containers are associated with sampling, the tape should be identified with the name of the seed sampling agency or company quality assurance logo, as well as date and initials of the sampler.

***Procedure for non-partitioned triers:***

This type of trier can only be used horizontally.

- The trier is carefully inserted horizontally into the container in the closed position until it reaches the opposite side of the container. Care should be taken not to push the trier through the opposite side of the container;
- The trier is opened and agitated slightly to allow the openings to fill;
- The trier is gently closed and withdrawn;
- The sample is deposited into a suitable clean container.

***Procedure for partitioned triers:***

This type of trier may be used horizontally or vertically.

- The trier is carefully inserted into the container in the closed position until it reaches the opposite side of the container. Care should be taken not to push the trier through the opposite side of the container;
- The trier is opened and agitated slightly to allow the openings to fill;
- The trier is gently closed and withdrawn;
- The sample is deposited on to a clean long piece of paper or into a suitable clean container that is the same length as the trier.



Sampling using a sleeve trier



## Nobbe Trier

This trier is a pointed tube with an oval opening near the pointed end. This trier is relatively compact and small, making it easy to transport. The risk of contamination is low as the trier is easy to keep clean. A Nobbe trier is suitable for sampling free-flowing seed in bags but not in bulk or mini-bulk containers. It may only be used horizontally. Its use is limited to penetrable containers. The Nobbe trier must be long enough that the opening (slot/hole) reaches the center of the bag.

### *Procedure for Nobbe trier:*

- The trier is inserted gently into the container with the trier opening facing downwards;
- The trier is inserted into the bag upwards at an angle of about 15-30° to the horizontal until it reaches the center of the bag;
- It is then rotated 180°, bringing the hole to face upwards;
- When the trier does not reach beyond the center of the container, the trier is withdrawn with decreasing speed so that the quantity of seed obtained from successive locations increases progressively from the center to the side of the bag. The trier should be gently agitated as it is being withdrawn to help maintain an even flow of seed. The trier must not be agitated without withdrawing;
- When the trier reaches the opposite end of the container, the trier is withdrawn with a constant speed. The trier should be gently agitated as it is being withdrawn to help maintain an even flow of seed. The trier must not be agitated without withdrawing.
- The sample must be deposited into a suitable clean container.



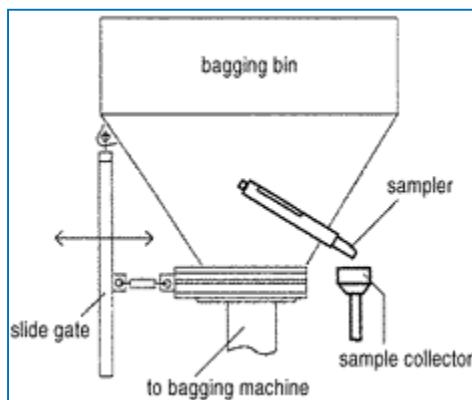
Sampling using a Nobbe trier

## B. SEED STREAM SAMPLING

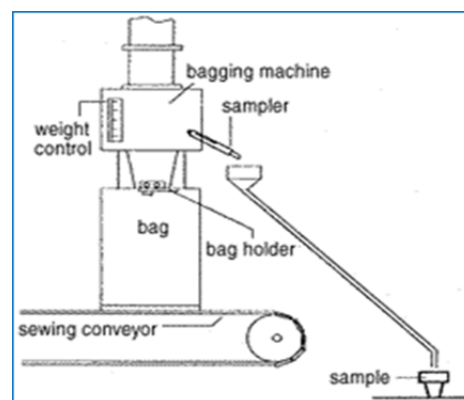
Where the uncleaned seed is processed in a closed system and the cleaned seed is packed into sealed marked containers, the primary samples may be taken from the seed stream. Sampling from the seed stream can be conducted manually or by automatic seed sampling devices. When devices are controlled automatically they are called 'automatic seed samplers'. Where there are open flow streams 'manual sampling' from the stream at the end of processing may be the best technique. The advantage to this technique compared to automatic stream sampling is that each individual primary sample can be examined for uniformity.

For drawing stream samples, these conditions must be met:

- The primary samples are to be taken during the process as the last step before the seed enters the containers which are to be sealed;
- The entire cross section of the stream must be sampled;
- Seed entering the sampling instrument must not bounce out again;
- Sampling the flow of the seed stream should be at regular intervals to the extent practical;
- Seed is not damaged nor selected according to seed size, buoyancy, and chaffiness.



Sampler installed in bagging bin



Sampler installed in bagging machine

## C. HAND SAMPLING

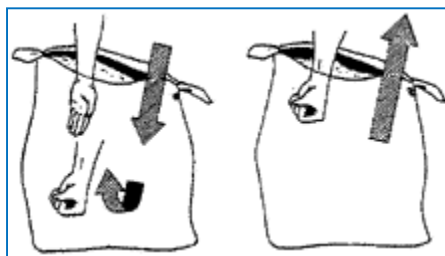
In certain cases and for certain species, especially chaffy, non-free-flowing grasses, hand sampling is the only alternative, where it has been determined by an attempt to sample by use of a trier, that the seed would be damaged or there could be separation and selection of the seed. An example of chaffy, non-free flowing grass seed is bermudagrass (*Cynodon dactylon*). All positions inside containers containing such seed must be accessible. Where it may be impossible to obtain samples from the lower parts of bags or bins, the seed sampler should request that the containers be partially or completely emptied to ensure access to all positions of the container.

The following procedure should be followed when:

- Open containers are greater than 40 cm (16") in depth; primary samples are taken directly from the open bag which has been emptied sufficiently to allow sampling from all parts of the bag;
- Containers are less than 40 cm (16") in depth; seed presented in this size container permits access to all parts of the lot. Primary samples are drawn. After sampling, the seed is re-packaged into the appropriate container and sealed;
- Samples are taken from the seed stream as the container is emptied and re-filled into a new container. The procedures for manual stream sampling are to be used.

#### ***Procedure for Hand Sampling:***

- The open hand is inserted through the top of the bag with fingers held tightly together, until the desired depth is reached;
- The hand is then closed with fingers held tightly together to ensure that few, if any, seed escape, and the hand slowly withdrawn;
- This process is repeated a number of times in different parts of the lot and at different depths, until the required sample size is obtained.



### **SAMPLING VARIOUS CONTAINERS**

#### **A. Sampling from Bags**

Each sealed container containing seed (e.g. polyethylene bag, paper bag, tins, cartons, etc.) is considered to be a unit for determining the number of containers in a seed lot, not the numbers of pallets on which the seed is stored. The sampler must randomly select the containers for sampling based on the number of primary samples required to obtain a representative sample of the lot. The sampler must ensure that the containers selected for sampling and those adjacent to the container being sampled are clean and free from debris by brushing or sweeping any extraneous material from the containers and the area before inserting the trier. The sampling pattern should be varied from top, middle and bottom bags on the pallet, and between pallets. At least three sides of a pallet are to be accessible for sampling. When sampling, it is recommended that the sampler start sampling at the bottom and work upwards. Therefore, the likelihood of the sampling operation causing contamination is reduced. To facilitate diagonal sampling of standing bags of up 100 kg (220 lb.) they must be laid flat. The holes in woven jute or poly bags made by

the trier must be closed by running the point of the trier across the hole a couple of times in the opposite directions to pull the threads together and close the hole. When the hole cannot be closed by this method, suitable adhesive patching tape/label shall be used, such as would be the case with paper bags. The patch must be signed and dated.



Seed in 25-lb bags on a pallet

For AOSA *Rules for Testing Seeds*, the sampling scheme is based on the number of bags of ordinary size (40-60 lb.) in a lot. If seed is in bulk, sample the same quantity as if in bags of an ordinary size (Table 1). For lots of one to six bags, each bag is sampled and a minimum of five primary samples must be collected. For lots of more than six bags, five bags plus 10% of the number of the bags in the lot must be sampled. Regardless of the lot size, it is not necessary to sample more than 30 bags.

Table 1. Sampling Intensity for the AOSA *Rules for Testing Seeds* as suggested by the AASCO *Handbook on Seed Sampling*.

Number of Bags in lots	7	10	23	50	100	200	300	400
Number of Bags to Sample	6	6	7	10	15	25	30	30

The following procedure should be followed precisely when sampling seed in bags:

1. Locate the seed lot and kind to be sampled.
2. Review bag and label information for lot number, kind, variety and seed treatment, if any.
3. Determine the number of bags in the lot.
4. Determine the number of bags required to be sampled (Table 1 above).
5. Select the proper trier to make sure that it reaches all portions of the container.
6. Inspect the trier to ensure that it is clean of seed from the previous lot sampled.
7. If the sample is for phytosanitary certification, wipe the trier with isopropyl alcohol prior to sampling.
8. Apply the following guidelines when taking samples:
  - a. Visually inspect each primary sample to assess uniformity;

- b. Stop sampling if non-uniformity is detected or record observation on the sampling report;
  - c. When drawing samples, approximately equal amounts of seed are to be taken with each primary probing and from each container; and
  - d. Combine all primary samples to form a composite sample.
9. Ensure enough seed is sampled to meet sample size requirements.
  10. Ensure that all trier holes are properly sealed.
  11. Seal and mark the sample for identification with the seed lot and sampling report.
  12. Treated seed samples must be identified with treatment information and the name of the treatment product must be shown on the sample container and the sampling report.
  13. Complete the sampling report while at the sampling location.
  14. Forward the sample and sampling report to the laboratory or other designated location using packaging appropriate for secure and timely shipping.

### B. Sampling from mini-bulk containers

Seed in mini-bulk containers is sampled by obtaining as many primary samples necessary to collect an equal amount of seed as if the quantity was in bags of a size customarily used for that kind. The following are guidelines for obtaining the minimum number of primary samples from mini-bulk containers:

Table 2. Minimum number of primary samples for mini-bulk containers of 1,000 – 3,000 lb.

Lot Size	Number of primary samples to be taken
1 container	At least 5 primary samples per bag
2-10 containers	One primary sample from at least 2 containers and no less than 6 primary samples
11 or more containers	One primary sample from at least 5 containers and no less than 6 primary samples



Mini-bulk containers or mini-totes

The following procedure should be followed as precisely as possible when sampling seed in mini-bulk bags and any exceptions should be noted:

1. Locate the seed lot and kind to be sampled.
2. Review the container and label information.
3. Determine the lot size and the number of mini-bulk containers per lot.
4. Determine the number of mini-bulk containers required to be sampled (Table 2 above).
5. Select the proper trier by making sure that it can reach all portions of the container
6. A minimum of five (5) primary samples are to be taken from uniformly distributed parts of the quantity being sampled using the following guidelines:
  - a. Do a visual inspection of each primary sample to determine uniformity;
  - b. Stop the sampling process if non-uniformity is detected or record observation on the sampling report;
  - c. When drawing samples, approximately equal amounts of seed are to be taken for each primary core and from each mini-bulk container sampled;
  - d. Combine the primary samples to form a composite sample; and
  - e. If the entire composite sample is not submitted, it must be blended before it is divided by using a standard method and equipment.
7. Ensure that enough seed is sampled to meet sample size requirements.
8. Ensure that all mini-bulk containers are properly sealed.
9. Complete the sampling report and cross reference it with the sample.
10. If the seed is treated, the sample container and the sampling report must show the name of the treatment product.
11. Forward the sample and sampling report to the laboratory or other designated location using packaging appropriate for secure and timely shipping.

### Sampling seed in bulk

Bulk seed refers to loose seed in shipping vehicles or in storage (Federal Seed Act, Title 1 – Definitions).



Loose seed in shipping vehicles



The following procedure should be followed as precisely as possible when sampling seed in bulk containers and any exceptions should be noted:

1. Locate the seed lot and kind to be sampled.
2. Review the label information for lot number, kind, variety and seed treatment, if any.
3. Determine the lot size (total weight or amount of seed in storage facility).
4. Determine the sample size according to a similar quantity in bags.
5. Select the proper trier by making sure it reaches all portions of the bulk container, if possible.
6. A minimum of seven (7) primary samples are to be taken from uniformly distributed parts of the quantity being sampled using the following guidelines:
  - a. Do a visual inspection of each primary sample to determine uniformity;
  - b. Stop the sampling if non-uniformity is detected or enter a remark on the sampling report;
  - c. When drawing samples, approximately equal amounts of seed are to be taken for each primary core;
  - d. Combine the primary samples to form a composite sample; and
  - e. If the entire composite sample is not submitted, it must be blended before being divided by using a standard method and equipment.
7. Ensure that enough seed is sampled to meet sample size requirements.
8. Ensure that all bulk containers are properly sealed, if applicable.
9. Complete the sampling report and cross reference it with the sample.
10. If the seed is treated, the sample container and the sampling report must show the name of the treatment product.
11. Forward the sample and sampling report to the laboratory or other designated location using packaging appropriate for secure and timely shipping.

### **Sampling the Retained Sample**

It is proper to obtain the retained sample at the time the submitted sample is also obtained. In that case the retained sample will be a duplicate sample following sample reduction. It can then be retained separately from the composite sample. However, if the retained sample was not obtained at the same time as the submitted sample, a retained sample may be taken from the composite sample. The method of sampling shall be determined by the sample retention system (sample storage method) and the size of the retained sample available with the conditioner. Approved sampling equipment must be used to obtain the sample. When the retained composite sample with the conditioner cannot be sampled by use of approved sampling equipment, the sampler shall mix and reduce the retained sample by using an approved mixing and reducing method. When the sampler can neither draw a sample using approved sampling equipment nor mix nor reduce the retained composite sample, the entire retained sample shall be submitted to the appropriate recognized seed laboratory.

**SAMPLE SIZE:**

If the primary samples appear uniform, they are combined to form the composite sample. For primary samples that are collected into the same bucket in the seed stream, the bucket may have a composite sample at the end of sampling process. The composite sample must look uniform to be acceptable. The composite sample is frequently too large and must be reduced to obtain the sample for submission to the recognized seed laboratory. This latter sample is known as the 'submitted sample'. Sample reduction by appropriate mixing and reduction methods is a requirement to ensure that no more variation than what would be expected in simple random sampling is introduced. If separate sub-samples from one seed lot are required for different tests (e.g. purity and/or germination, disease, moisture determination), these sub-samples must be taken by either sampling the lot again, or mixing the entire composite sample and using the approved mixing and reduction method (Riffle Divider) to obtain each required sub-sample, or submitting the entire composite sample to the recognized seed laboratory as directed by that laboratory. The container of a submitted sample shall bear the following information: company and location of sampling, crop kind and variety name, lot number, date of sampling, signature of sampler, weight of lot, and laboratory tests requested. The samples will be sealed. The submitted sample must be forwarded to the laboratory in a timely manner. The sample must be stored in such a manner that the integrity and quality of the sample may not be compromised. It will be only after the samples are sealed by the sampler that those for testing can be handled by other personnel.

The CCIA recently developed a Seed Laboratory Recognition Program (SLRP) where different public and private laboratories conduct seed tests on seed samples submitted by conditioners for seed certification in California. The SLRP has established minimum seed sample sizes (Refer to page 23) that meet the California Seed Law and the Federal Seed Act apart from meeting all CCIA test requirements. These sample sizes include the minimum retained sample to remain with the conditioner, the amount required for any special tests, e.g. dodder seed presence in alfalfa, Ascochyta Blight (*Ascochyta rabiei*) in chickpea, Rice Blast (*Pyricularia grisea*) in rice, and Bacterial Fruit Blotch, BFB (*Acidovorax avenae* subsp. *citrulli*) in watermelon, and the submitted sample. The submitted sample is required to be enough to include two working samples, i.e. one for the seed test by the seed laboratory and the other sample to be retained by the laboratory. The expectation is that any of the submitted samples can be queried by the SLRP as a requirement for the 10% check tests on any of the conditioners' seed lots. If the SLRP queries a seed lot, the conditioner will submit the retained sample. In case of any arising complications, the SLRP and CCIA may require the submission of the other part of the submitted sample from the seed laboratory. The in-house CCIA laboratory will conduct a test on the retained sample sent by the conditioner and that from the seed laboratory and will compare and verify results with the test conducted on the seed laboratory retained sample.

CROP	CONDITIONER				LABORATORY
	MINIMUM RETAINED SAMPLE FOR CCIA	CCIA SPECIAL TESTS	SUBMITTED SAMPLE TO LABORATORY	NOXIOUS WEED SAMPLE	1 YEAR RETAINED SAMPLE FOR CCIA
Alfalfa	1000 grams	400 grams	1000 grams	50 grams	550 grams
Asparagus, Hybrid	500 grams		500 grams	500 grams	0 grams
Bean, Lima	1500 grams		1500 grams	500 grams	1000 grams
Bean, Lima Fordhook	2500 grams		2500 grams	500 grams	2000 grams
Beans	1000 grams		1000 grams	500 grams	500 grams
Bermuda Grass	55 grams		55 grams	10 grams	45 grams
Celery	25 grams		25 grams	25 grams	13 grams
Chickpea	1000 grams	400 grams	1000 grams	500 grams	500 grams
Clover, red	1000 grams	400 grams	1000 grams	50 grams	550 grams
Clover, white	1000 grams	400 grams	1000 grams	20 grams	580 grams
Corn	1000 grams		1000 grams	500 grams	500 grams
Corn, Hybrid	1000 grams		1000 grams	500 grams	500 grams
Cotton	1000 grams		1000 grams	500 grams	500 grams
Cowpea	1000 grams		1000 grams	500 grams	500 grams
Field Pea	1000 grams		1000 grams	500 grams	500 grams
Flax	300 grams		300 grams	150 grams	150 grams
Grain	1000 grams		1000 grams	500 grams	500 grams
Rape	200 grams		200 grams		100 grams
Rape, Hybrid	200 grams		200 grams		100 grams
Rice	2000 grams	30 grams	2000 grams	500 grams	1000 grams
Safflower	1000 grams		1000 grams	500 grams	500 grams
Sorghum/Sudangrass	500 grams		500 grams	500 grams	250 grams
Sorghum/Sudangrass, Hybrid	500 grams		500 grams	500 grams	250 grams
Sunflower	1000 grams		1000 grams	500 grams	500 grams
Watermelon	1000 grams	BFB	1000 grams	500 grams	500 grams
Watermelon, Hybrid	500 grams	BFB	500 grams	500 grams	0 grams
Wild Rice	1000 grams		1000 grams		500 grams

**SAMPLE REDUCTION:**

The composite sample must be removed from the container in which it was placed in such a manner that all seed is retained. Therefore, if the composite sample is in a cloth bag, carefully remove the contents and turn the bag inside out and check the seams for seed. Seed with barbs, awns, hairs, etc. may adhere to the bag or become caught in the seams. However, if the sample is in containers (e.g. pails) then carefully remove contents and check for seed adhering to the sides and bottom of the container. The composite sample should be placed into a seed scoop or one of the Riffle divider collection containers. It is beneficial to weigh the composite sample prior to mixing and reduction. After mixing, calculations can be made to approximate the number of reduction steps needed to obtain the submitted sample weight that meets the minimum sample size. Appendix 4 shows the different equipment that is appropriate for reducing the composite samples to the submitted sample size of different crop kinds.

The **Conical** divider (**Boerner** type) consists of a hopper, cone and series of baffles directing the seed into two spouts. The baffles form alternate channels and spaces of equal width. They are arranged in a circle at their summit and are at their summit and are directed inward and downward, the channels leading to one spout and the spaces to an opposite spout. A valve or gate at the base of the hopper retains the seed. When the valve is opened the seed falls by gravity over the cone where it is evenly distributed to the channels and spaces, then passes through the spouts into the seed pan. The divider should have about 38 channels each 25mm wide for large seeded crop kinds and 44 channels each 8mm wide for small-seeded crop kinds.

With the **Centrifugal** divider (**Gamet** type), the seed flows downward through a hopper onto a shallow cup or spinner. Upon rotation of the spinner by an electric motor the seeds are thrown out by centrifugal force and fall downward. The circle or area where the seeds fall is equally divided into two parts by a stationary baffle so that approximately half the seeds fall in one spout and half in the other spout. The Gamet tends to give variable results unless the spinner is operated after having poured the seed centrally into the hopper and/or unless it is placed level.

The **Riffle** divider is the most widely used equipment for sample reduction. It consists of a hopper with about 18 attached channels alternately leading to opposite sides. It must be placed on a firm, level surface and be kept and stored in a clean, dry environment. The sampler must ensure that the divider and the collection containers are not damaged. The divider or the collection pans must not be banged together to clean nor tools such as mallet, hammer or knife used to clean them. Wherever possible, compressed air should be used to clean the divider and collection containers. If the divider is being transported, it should be packaged in a padded box or carrying case to ensure that it will not be damaged. If the divider or collection pans are dirty or oily, they can be washed with warm water and mild detergent. The divider should be dried thoroughly with a soft lint-free cloth that will not leave any residue on the equipment and left to dry at least overnight. **Caution:** Care should be taken when mixing and reducing pulse crop seed such as peas because the impact of the seed in the pan may cause seed breakage. The composite

sample is divided into two approximately equal parts. The composite sample is mixed by passing it through the divider, recombining the two parts and passing the whole sample through a second time and similarly a third time. The sample then is reduced by passing the seed through repeatedly and removing one-half on each occasion. This process of successive halving is continued until a submitted sample of the required size is obtained.

**Submitted Sample Container**

The suitability of the sample container will depend on the quality of the seed lot and the types of tests requested. Where percentage pure seed, germination, other seed counts, purity of variety, disease test or tetrazolium test are requested, the most suitable container is an unused clean cloth or paper bag or good quality manila envelope. Where a test for moisture determination is requested these samples shall be packaged in moisture-proof containers. Samples should never be left unprotected and should not be exposed to moisture, heat or direct sunlight.



## PHOTOGRAPHS



Nobbe Triers



Nobbe Triers



Sleeve Triers



Mini Totes



Sampling Clover Seed



Sampling in bags with the Nobbe Triers





Boerner divider



Gamet divider



Riffle divider



Pallet



Sample Envelops



Cloth Sample Bags



Mini-Bulk



Sleeve Trier Sampling



Documentation of Records



Seed Harvesting



Seed Transportation



Harvester Cleaning



Labels



Bulk Sampling



Bulk Seed



Seed Warehouse



Seed Bags



Stitching Tag on Bag



Seed Bags for Shipping



Bags and Bins in Warehouse

## HEALTH AND SAFETY

Seed sampling normally occurs in warehouses with bins, bags and many other items that may be physically hazardous to personnel. Health and safety is therefore of paramount concern in any seed sampling activities. Supervisors have the responsibility to ensure that all inspection staff receive the appropriate level of Health and Safety as well as Transportation of Dangerous Goods training for the work duties assigned. Appropriate safety procedures and precautions must be followed at all times when sampling. The sampler needs to be instructed on how to access any OSHA and Cal/OSHA publications, manuals and analyses that apply to the tasks performed. When sampling the sampler must always wear the appropriate personal protective equipment (PPE) such as a hard hat, approved work boots, goggles, hearing protection, gloves and respirator. The sampler should be aware of safe work procedures, hygiene practices, personal protective equipment/clothing and safe work practices.

Without appropriate precautions, seed sampling could be hazardous. The Health and Safety training provided to the sampler will instruct them to abide by the following requirements:

- Advise the conditioner of the sampler's presence and are in which they will be during sampling and time they expect to leave the premises;
- Enquire about potential hazards, emergency response plan and exits and location of Material Safety Data Sheets (MSDSs);
- Ensure that they are aware of the fumigation schedule of the warehouse and allow sufficient time to pass after fumigation before sampling. They should read product labels and consult the MSDS for the insecticide, fumigant or other chemicals used in the warehouse to determine what safety measures to follow in the event of any emergency;
- Exercise caution when sampling or working in an area where there is treated seed;
- Use explosion-proof flashlights since dust can easily be encountered in inspections;
- Never attempt to move bags/containers of seed. The sampler is to request that the conditioner move the seed lot such that it will be stable, accessible and safe to sample;
- Request that the seed lot be moved when the seed lot is in bags stacked such that the top row cannot be reached. The sampler must never climb bags of seed;
- Be aware of and avoid electrical hazards;
- Be aware of lighting hazards;
- Be aware of moving vehicle hazards like forklifts. The sampler must watch for moving equipment and give this traffic the right of way at all times;
- Exercise caution when sampling from bins, railcars and trucks;
- Use proper techniques when carrying equipment and when using sampling equipment;
- Carry a cellular phone at all times, when possible, during sampling.

When sampling a seed lot that has been treated with a pesticide, the sampler should be careful in order to minimize the risk of unnecessary exposure to the pesticide. The sampler should pay particular attention by reading the label attached to the container for appropriate precautions. The sampler should also observe general safety measures as:



- Wear protective clothing, e.g. coveralls, gloves, and a mask;
- Wear a respirator equipped with air filters approved for pesticide use if prolonged exposure is expected;
- Documentation for the purposes of identifying the sample (e.g. labels, Sample Form, etc.) must not be placed inside the sample container;
- The sample must be identified as a 'treated' sample. The name of the treatment product must be stated on the Sample Form. The sample container must also carry sample and treatment identification;
- A sample of 'treated' seed must be placed in an inner cloth bag or envelop. The sample container must be placed in a plastic bag and securely closed.

After sampling treated seed lots, the following precautions must be observed:

- Wash hands and face;
- Never smoke, drink or eat prior to washing hands and face;
- Clean sampling trier and other sampling equipment;
- Avoid consuming food or drink in plant or office areas exposed to treatment products;
- Ensure that respirator air filters are replaced within the recommended time period suggested by the manufacturer.

### ***Cal/OSHA Recordkeeping and Reporting***

The California Division of Occupational Health (Cal/OSHA) requires recordkeeping and reporting about safety in the workplace. Required records include the OSHA 300 Log and documents about safety hazard analysis, inspections, and accident investigations. Hazard-specific regulations such as asbestos, diving, mining, etc. also have additional recordkeeping requirements. Keeping track of recordkeeping requirements is a challenge.

The OSHA 300 log is probably the most familiar to workers and employers. It records all work-related deaths along with injuries and illnesses that require more than first aid treatment. An annual summary of injuries and illnesses is required to be posted in the workplace. Some small businesses (less than 10 employees) and certain industries may have limited exemptions from this recordkeeping requirement. All Employers must report to Cal/OSHA any serious injury, illness or death of an employee immediately, but no longer than 8 hours after the employer knows or with diligent inquiry would have known. If the employer can demonstrate that exigent circumstances exist, the time frame for the report may be made no longer than 24 hours after the incident.

Cal/OSHA also requires employers to keep records on hazard evaluations and the corrective actions taken to reduce or control safety risks in the workplace. Job hazard analysis (JHA) evaluates a worker's job tasks, tools, equipment, and procedures to determine the level of safety

risk and how to control it. Also examine and plan for hazards associated with new tools, equipment, chemicals, tasks, and work environments. Keeping records of these hazard evaluations and risk reduction efforts can document that a business has diligently worked to protect workers. Communicate with employees about these evaluations to make them aware of job hazards and help them work safer.

Periodic workplace safety inspections identify hazards in the workplace. Keep records of the identified hazards and the actions that were taken to correct them. Investigate all employee accidents and near misses to determine the root cause of the accident. Document any corrective actions taken to reduce the risk of further accidents. Take the same steps when investigating employee complaints by recording the investigation process and any necessary corrective actions. Communicate the results of inspections, accident investigations, and complaint response to employees.

Safety training is a key component in making employees aware of the risks and hazards involved with their work tasks along with the appropriate work practices and personal protective equipment that keeps them safe. General safety training may include ergonomics, first aid, CPR, and injury and illness prevention. Specific work task and hazards safety training can target chemical use, fall protection, lockout/tagout, etc. Keep records of all employee safety training.

With all of this recordkeeping, it may be confusing about how long to keep safety records. Storage time requirements range between 1, 3, and 5 years. Check the specific regulations that apply to your industry, but as a best practice, store safety and training records for 5 years. Note that some regulations have separate recordkeeping requirements and timelines. For example, asbestos training records are required to be kept one year past the last date of employment of a worker. Employee medical records need to be kept for the length of employment plus 30 years.

Cal/OSHA posting requirements ensure that you communicate about safety and hazards in the workplace. Every place of employment should have the Job Safety and Health Protection poster placed in a prominent area. Copies of all Cal/OSHA citations must be posted for 3 days or until the violations are corrected. Finally, post notices of Cal/OSHA investigations, complaints, and the required employer response for 3 days.

Employers must provide their employees access to safety records within a reasonable timeframe (usually 7 days) and must notify employees when monitoring indicates that they have been exposed to a hazard. Employees have a right to information and records about hazardous chemicals in the workplace (Material Safety Data Sheets), hazard exposure monitoring, and their own safety, personnel, and medical records. Employees also have the responsibility to report all workplace hazards, illnesses, injuries, accidents, and near misses so they can be evaluated and prevented in the future.

**Appendix 1**

Sampling equipment can be divided into five major categories:

<b>Type of Equipment</b>	<b>Equipment</b>	<b>Used for/to:</b>
Triers/Probes	Partitioned Sleeve type trier	Horizontal or vertical probing
	Non – Partitioned Sleeve type trier	Horizontal probing only
	Nobbe trier	Horizontal probing only
Containers	Buckets Primary bucket Clean paper Composite bucket	Collection of primary samples
	Submitted sample container (envelops and sample bags)	Submit sample to laboratory
Dividers	Boerner divider Riffle-Soil divider Centrifugal divider Rotary divider	Mix and reduce composite sample to submitted sample size
Weighing equipment	Balance	Weighing submitted sample
Protection	Goggles, gloves, hearing protection, respirator, hard hat, work boots and coveralls	Personal protection



## Appendix 2

Table 3. Suggested sampling trier selections for specific seed types in different container sizes

Seed Type	Crop Kind	Min Slot Width	Containers 50 lb.	Containers >50 lb.	
				Horizontal <sup>1</sup>	Vertical <sup>1</sup>
Small 4mm ( $\frac{1}{8}$ "	Small legumes (Clovers, Alfalfa); Brassicas (Rape); Fine grasses (Teff);	7 mm ( $\frac{1}{4}$ "	Sleeve Nobbe	Sleeve Nobbe	Partitioned sleeve
Medium 8mm ( $\frac{5}{16}$ "	Grain (Wheat, Oat, Barley, Rye, Triticale); Rice; Sorghum; Medium Vegetables (e.g. Asparagus); Safflower	14mm ( $\frac{1}{2}$ "	Sleeve Nobbe	Sleeve Nobbe	Partitioned sleeve
Large 15mm ( $\frac{5}{8}$ "	Large legumes (Field pea, Cowpea, Chickpea, Bean); Sunflower; Corn; Cotton; Large vegetables (e.g. Watermelon)	19mm ( $\frac{3}{4}$ "	Sleeve Nobbe	Sleeve Nobbe	Partitioned sleeve
Very chaffy grasses	Chaffy brome grass, orchard grass	N/A	Hand	See note <sup>2</sup>	See note <sup>2</sup>


<sup>1</sup>For horizontal probing of large containers, Nobbe triers must reach the center of the container and sleeve triers must either reach the opposite side of the container or the center of the container can be probed from both sides.

<sup>2</sup>Probing of very chaffy grasses in large containers is difficult. Sampling is best done by stream or by hand.

## Appendix 3

## Matching Crop Kinds with Trier Size

Seed Type	Crop Kind	Min Slot Width	Sleeve Trier (Bag or Bulk)	Nobbe Trier (Bag only)
Small 4mm ( $\frac{1}{8}$ " )	Small legumes (Clovers, Alfalfa); Brassicas (Rape); Fine grasses (Teff);	7 mm ( $\frac{1}{4}$ " )	See C below	See D below Should be sufficient to reach the center of all types of bags
Medium 8mm ( $\frac{5}{16}$ " )	Grain (Wheat, Oat, Barley, Rye, Triticale); Rice; Sorghum; Medium Vegetables (e.g. Asparagus); Safflower	14mm ( $\frac{1}{2}$ " )	See B below	See D below Should be sufficient to reach the center of all types of bags.
Large 15mm ( $\frac{5}{8}$ " )	Large legumes (Field Pea, Cowpea, Chickpea, Bean); Sunflower; Corn; Cotton; Large vegetables (e.g. Watermelon)	19mm ( $\frac{3}{4}$ " )	See A below Up to 1600mm (5'3") long, outside diameter 38mm (1 $\frac{1}{2}$ " )	N/A

	Trier	Length (in.)	OD <sup>1</sup> (in.)	Slot Size (in.)
	A	63	1 $\frac{1}{2}$	$\frac{7}{8}$ x 3 $\frac{3}{8}$
	B	39	$\frac{3}{4}$	$\frac{1}{2}$ x 2 $\frac{3}{4}$
	C	29	$\frac{1}{2}$	$\frac{5}{16}$ x 1 $\frac{3}{4}$
	D	19 $\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$ x 1 $\frac{1}{2}$
	E	6 $\frac{1}{8}$	Dollar Bill	
<sup>1</sup> = Outside diameter				

**Appendix 4**

## Mixing and Reduction Equipment

<b>Seed Type</b>	<b>Example Crop Kinds</b>	<b>Preferred Suitable Dividers or Method</b>
Small, maximum seed length 4 mm ~ $\frac{1}{8}$ "	Small legumes (Clovers, Alfalfa); Brassicas (Rape); Fine grasses (Teff);	Conical (Small Boerner) Centrifugal (Gamet) Rotary
Medium, maximum seed length 8 mm ~ $\frac{5}{16}$ "	Grain (Wheat, Oat, Barley, Rye, Triticale); Rice; Sorghum; Medium Vegetables (e.g. Asparagus); Safflower	Soil divider (Riffle) Conical (Large Boerner) Centrifugal (Gamet) Rotary
Large, maximum seed length 15 mm $\frac{5}{8}$ "	Large legumes (Field Pea, Cowpea, Chickpea, Bean); Sunflower; Corn; Cotton; Large vegetables (e.g. Watermelon)	Soil divider (Riffle) Conical (Large Boerner) Centrifugal (Gamet)
Very chaffy grasses	Chaffy bromegrass, orchardgrass	Hand halving

## Appendix 5

## AASCO RECOMMENDED MAXIMUM LOT SIZE

CROP	LOT SIZE (lb)
Corn	150,000
Soybeans	150,000
Wheat, Barley	150,000
Oats, Rye, Triticale	100,000
Lentils, Lupins, Peas, Beans, Faba beans	150,000
Sorghum, Sudangrass	100,000
Vetches, hairy, Hungarian, common	150,000
Sunflower, Safflower, Cotton	100,000
Canola, Mustard, Oilseed Radish	100,000
Buckwheat, Canarygrass	75,000
Flax, Camelina	50,000
Large-seeded grasses	75,000
Small-seeded grasses	55,000
Grass mixtures	25,000
Vetches, crown, kidney, cicer milkvetch	50,000
Sainfoin	50,000
Small-seeded forage legumes	55,000
Coated or Pelleted Seeds, Mats, Tapes, etc.	1 billion seeds [coat/tape/mat < 42,000 kg]

