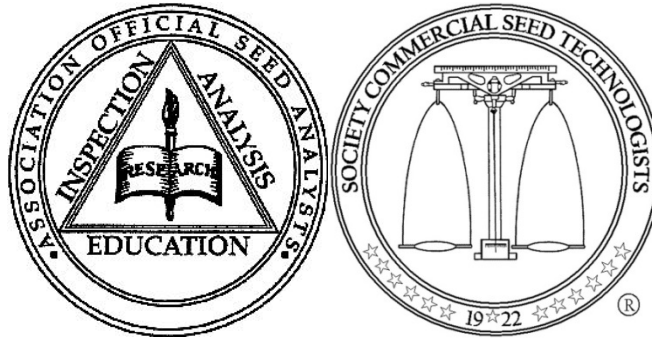


**Society of Commercial Seed Technologists
Association of Official Seed Analysts**

RST/CVT/CPT CSA Study Guide



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Introduction

SCST

The Society of Commercial Seed Technologists is a seed testing organization comprised of commercial, independent and government seed technologists. Formed in 1922, the SCST functions as a liaison between the Association of Official Seed Analysts (AOSA) and the American Seed Trade (ASTA). The SCST has developed over the years into a progressive organization that trains and provides accreditation of technologists, conducts research studies and proposes rule changes, and serves as an important resource to the seed industry.

AOSA

The Association of Official Seed Analysts (AOSA) is an organization of member laboratories which was established in 1908. Members include official state, federal, and university seed laboratories across the United States and Canada. The objective of the association is to improve seed testing in all its branches and to make it more useful to agriculture and society. To assure a high standard of quality individuals within the AOSA member laboratories have acquired AOSA Certified Seed Analyst status by taking and passing the AOSA/SCST Purity and Germination Exams.

SCST Mission Statement

SCST promotes professionalism and ensures proficiency by examining and continuing to educate seed analysts. This provides accurate and timely information to the seed industry. The SCST will build upon these strengths by broadening the membership base to include emerging technologies. SCST will continue to promote research and develop publications which enhance seed technology.

AOSA Mission Statement

The Association of Official Seed Analysts establishes the AOSA Rules for Testing Seeds; contributes to the refinement and modification of the rules and procedures for seed testing; ensures that testing procedures are standardized between analysts and between laboratories; influences and assists in enforcement of appropriate seed legislation at state and federal levels; tests and certifies Certified Seed Analysts in both purity and germination analysis.

SCST Membership Categories

There are eight membership categories in the SCST. Five of the membership categories (RST, RGT, CGT, CVT, and CPT) require qualifying for and passing an examination. Research members have to meet certain qualifications related to access to research facilities and research history in order to become members. Association membership is open to all individuals with an interest in seed testing.

Membership categories:

1. Registered Seed Technologist (RST)
2. Registered Genetic Technologist (RGT)
3. Certified Genetic Technologist (CGT)
4. Certified Viability Technologist (CVT)
5. Certified Purity Technologist (CPT)
6. Research Member
7. Associate Member
8. Honorary Member

Registered Seed Technologist (RST)

These are individuals who have successfully qualified for and passed the RST/CSA exam. The current qualifications include a minimum of two years' work experience, and accumulation of 100 points from workshops, college courses, and work experience.

The RST/CSA exam includes written purity and germination exams as well as purity and germination practical exams. Detailed information on exam content is available later in this document.

RSTs are required to complete continuing education in order to maintain membership and are required to pay annual membership dues. They must sign a contract for Privilege of Use of the Society's name, logo, RST seal, and the title Registered Seed Technologist. Appendix E contains a sample contract.

RSTs have one vote on all Society business and can vote on the amendments to the AOSA for Rules Testing Seeds. RSTs are eligible to run for elected office and can chair or participate in committees.

Certified Viability or Purity Technologist (CVT/CPT)

Individuals who have successfully qualified for and passed the CVT or CPT exam. The current qualifications include a minimum of two years of work experience and accumulation of 100 points from workshops, college courses, and work experience.

The CVT exam includes a written germination exam as well as a germination practical exam.

The CPT exam includes the written purity exam, seed separations, seed identification practical exams and a full purity analysis. Detailed information on exam content is available later in this document.

CVTs and CPTs are required to complete continuing education in order to maintain membership and are required to pay annual dues. They must sign a contract for Privilege of Use of the Societies name, logo, and the title Certified Viability or Purity Technologist. Appendix E contains a sample contract,

CVTs and CPTs have one vote on all Society business and can vote on the amendments to the AOSA for Rules Testing Seeds. They are eligible to run for elected office and chair or participate in any committees.

Research Member

Individuals engaged in seed technology-related research. They must have a minimum of a B.S. degree in agriculture or related field benefiting seed technology. They must provide evidence of employment in teaching, research, and outreach in the field of seed technology. Self-employment in agronomic services is acceptable with a minimum of 500 hours per year. They must also provide evidence of outreach productivity in seed technology during the past two years. Evidence will include, but not necessarily be limited to, article(s) in peer-reviewed publications and educational and/or informational presentation(s). They must also have access to a research facility and be unanimously approved by the Examination Committee. They have one vote on all Society business and can vote on the amendments to the AOSA for Rules Testing Seeds. They are eligible to run for elected office and chair or participate in any committees.

Associate Member

Individuals with an interest in seed technology or pursuing an accreditation. They shall have no vote, shall not hold elective office, and shall not have use of the Seal, Seal Number, Insignia or Name of the Society but may chair or serve on committees and participate in all Society activities.

AOSA Certified Analyst Categories

There are three AOSA certified analyst categories, all of which require that one qualify for and pass an examination.

1. Certified Seed Analyst (CSA)
2. Certified Seed Analyst – Germination (CSA-G)
3. Certified Seed Analyst – Purity (CSA-P)

The RST/CSA examination includes written purity and germination exams as well as purity and germination practical exams. The application for applying to take the **exams** can be found on the AOSA website at www.aosaseed.com. CSA analysts may be certified in germination, purity or both.

Certified Seed Analysts

Employees of public sector seed laboratories that have successfully qualified for and passed the RST/CSA exams in germination and purity. The current qualifications include work experience

and accumulation of 100 points from workshops or college courses.

Certified Seed Analyst-Germination (CSA-G)

Employees of public sector seed laboratories that have successfully qualified for and passed the Germination exam. The current qualifications include a minimum of two years of work experience, and accumulation of 100 points from workshops, college courses, and work experience. The Germination exam includes a written and a practical exam.

Certified Seed Analyst – Purity (CSA-P)

Employees of public sector seed laboratories that have successfully qualified for and passed the Purity exam. The current qualifications include a minimum of two years of work experience, and accumulation of 100 points from workshops, college courses, and work experience. The Purity exam includes the written purity exam, seed separations, and seed identification practical exams.

Points Required to Qualify for the Exams

In order to take the RST/CSA, CVT/CSA-G, or CPT/CSA-P exams you must accumulate a minimum of 100 points. Points can be accumulated from the following activities:

- A. Accepted college level courses in botanical science or seed technology - 2 points for each earned quarter credit hour, 3 points for each earned semester credit hour. Maximum of 50 points allowed.

Examples of courses that will be accepted:

General Botany	Plant Physiology
Plant Pathology	Cytology
Ecology	Agronomy, Forage Crops (excluding soils)
Morphology	Seed Technology (identification, purity, germination)
Biology	Horticulture

- B. Verified attendance at approved seed schools workshops, or webinar - Maximum of 20 points allowed.

Note: An additional 5 points will be allowed in this category for full attendance at an AOSA-SCST Annual Conference (in the year prior to taking the examination).

Approved seed schools, workshops, and webinars are those that are directly related to seed science or technology and have been assigned in advance by the Executive Director or their appointee for continuing education points.

1. One day (6 hours) – 2 points
2. One half day (4 hours) - 1 point
3. Webinars – 1 point

The Board of Examiners (BOE) is authorized to decide the acceptability of seed school training other than above.

- C. Training under the supervision of a qualified seed technologist or analyst in purity analysis and germination. 1 point for each 80 hours of training.

- D. Unsupervised testing experience in purity and germination. 1 point for each 160 hours of experience. SCST candidates are required to participate in the tutorial program if they do not have a qualified trainer on site (see below.)
- E. Combination of 3 and 4 above which together meet the requirement of a minimum of 2 years' experience in hands-on seed testing.
- F. If hands-on seed testing experience was obtained earlier than the immediate two years prior to submitting an application for the RST examination applicant shall complete the following additional requirement:
 - Proof of five points of hands-on continuing education for each year between time of original training and applying for the examination.

Training

In order to prepare for the exam it is strongly suggest that you find a qualified trainer on site. (This will satisfy the requirement of “training under direct supervision” where 1 point is earned for every 80 hours of training.) Qualified trainers include RSTs, CVTs, CPTs, AOSA Certified Seed Analysts, CSAAC Senior Members, ISTA laboratory managers and other individuals approved by the RST Board of Examiners. The trainer is often your present supervisor or coworker. They can also be another individual outside of your laboratory who is qualified and agrees to assist you in your studies on site. It will be the trainer’s responsibility to use their experience to assist in your training. The trainer will help you plan and set a course of study and will periodically test you to see if you are progressing. They will direct you toward your goal of passing the examination and becoming an accredited analyst.

Tutorial Program

This is a distance-training program for SCST analysts who do not have a qualified trainer at their laboratory location. (This will satisfy the requirement of “unsupervised testing experience” under the guidance of a qualified tutor- 1 point for each 160 hours of experience). The SCST Executive Director or the Teaching and Training co-chairs can help you find a tutor. However, the details of the arrangement must be worked out between the tutor and the trainee. (See Appendix D for forms and details.)

Applicants need to notify the Executive Director when a tutorial program begins. A list of items which shall be completed in a twelve month period will be developed by the tutor and the trainee. This document is signed by the tutor, the student, and the student's employer and returned to the Executive Director. In order to receive credit for the tutorial program the following must be completed:

1. Quarterly (13 weeks) reports shall be signed and filed with the Membership Director within two weeks of completion.
2. At least two weeks each year shall be under the *direct* supervision of the tutor. Details of each tutorial program will be worked out between the tutor and the applicant.

3. The following individuals are considered qualified supervisors or tutors:
- Registered or Certified Member of the Society of Commercial Seed Technologists.
 - Certified Seed Analysts of the Association of Official Seed Analysts.
 - Senior Member of the Commercial Seed Analysts Association of Canada.
 - Supervisor of an International Seed Testing Association member lab.
 - Other individuals approved by the RST Board of Examiners.

AOSA & SCST Exam Qualifications and Requirements

Requirements	Must be currently employed in seed testing and have 2 years full time experience, equivalent to 4000 hours. Or equivalent as determined by Board of Examiners. SCST: Candidates for Registered Membership (RST) must be an Associate Member for 2 years prior to taking the examination.
Qualifications	100 points: work experience, workshops, and acceptable college courses (see “Points Required to Qualify for the Exams”). Fulfill the qualifications prior to the examination. Written recommendation(s) that the applicant is competent to take the exam and become an accredited analyst. SCST: three references regarding your technical ability. Your trainer, someone to vouch for your employment and an SCST accredited member other than your supervisor or tutor. AOSA: one reference from a qualified member of your laboratory that can vouch for your technical ability.
Herbarium	RST, CPT, CSA-Purity candidates must submit a 150 seed herbarium collection reviewed by the BOE at the time of the exam-OR- Candidates are allowed to submit a voucher from lab supervisor that the member lab has a herbarium with at least 150 kinds of seed: common crops, federal and state noxious weeds. The voucher form must describe how the herbarium is organized.
Laboratory	SCST: Lab must be inspected to determine if it has met the minimum requirements for equipment, reference material and methods.
Application	Submitted to Executive Director at least 60 days prior to exam date. Available on the SCST and AOSA websites or by contacting the Executive Director. SCST: Unanimous approval by Board of Examiners. If unanimous approval cannot be obtained, the SCST Executive Board will act as a Board of Review. AOSA: Obtain approval of the AOSA Exam Co-chair.

Exam fee	\$300 for individual exam (either purity or germination) \$500 for both purity and germination
Location and Frequency	Once a year in each region (as needed,) hosted by an approved/designated AOSA or SCST member lab (can take the place of a regional exam.)
Grading	Completed written and practical exams are sent to Executive Director. Exams are coded and distributed to graders. At least 2 committee members grade each exam, and chairs also review.
Passing Grades	≥70% written exam ≥80% practical exam ≥80% overall average

The Examinations

Exam candidates should think of taking examinations as the beginning step of training in seed analysis and not the conclusion. The examinations are offered at various times, at various locations throughout the year. Each exam is allotted one eight hour day. For detailed time allotments see: http://www.seedtechnology.net/rst_cvt_cpt_exam.

Viability/Germination examination consists of two sections: viability/germination written and viability/germination practical. The following is a breakdown of exam content:

Written portion (150 points)

- Germination composed from pool of questions based on key exam references
- Tetrazolium questions
- Vigor questions
- Sample preparation (obtaining an acceptable sample for planting)
- Pure Seed Unit definitions

Practical portion (100 points)

- 90% Seedling classification
- 10% Tetrazolium viability test evaluation

Purity examination consists of two sections: purity written and purity practical. The following is a breakdown of exam content:

Written portion (150 points)

- Composed from pool of questions based on key exam references: sampling, examinations, classification, blowing procedure, definitions, etc.
- Scientific name for 25 common names

Practical portion (210 points)

- Mixing and dividing
- Seed ID (50 seeds @ 2 points each)
- Separations
- Purity sample
- Pure Seed Unit classification
- Uniformed Blowing Procedure

Passing Grades

An applicant shall fulfill the following qualifications:

1. Have a grade of 70% or better on the written part of the examination, and 80% or better on practical portion of exam.
2. Have an average grade of 80% or better for the entire examination.

Preparation for the Examination

There are many resources available to help you with your training in seed analysis. The SCST has published a *Seed Technologist Training Manual* that is an invaluable tool for anyone studying to become a Registered or Certified Technologist (contact the Executive Director or visit the website to order.) In addition the SCST Seed Library has seed study sets that may be borrowed. For more information about the seed library visit the website http://www.seedtechnology.net/seed_library. Another resource is a Mentor Program available to assist examinees in particular areas of studying for the examination. This mentoring program is administered by the Executive Director and Teaching and Training committee of the SCST. You can learn more at <http://www.seedtechnology.net/>

The Society of Commercial Seed Technologists (SCST) recommends study in the following areas to become proficient in seed technology:

Viability (germination)

1. Identification of pure seed units.
2. Analytical technique in purity, germination, Tetrazolium and vigor tests.
3. Evaluation of normal and abnormal seedlings of field and vegetable seeds.
4. Knowledge of botany as applied.
5. Canadian and Federal Seed Laws.
6. AOSA Rules for Testing Seeds
7. Labeling and tolerances as applied

Purity

1. Identification of field, vegetable, noxious and common weed seeds.
2. Identification of inert material.
3. Knowledge of botany as applied.
4. Canadian and Federal Seed Laws.
5. AOSA Rules for Testing Seeds
6. Labeling and tolerances as applied.

Essential Material for Study in Preparation for the Viability Examination

- Seed Technologist Training Manual. SCST (2001)
- Rules for Testing Seeds. Volumes 1 – 4. AOSA (www.aosaseed.com)
- Seed Vigor Testing Methods Handbook. AOSA
- Tetrazolium Testing Handbook AOSA
- Cultivar Purity Handbook. AOSA
- Rules & Regulations under Federal Seed Act. 1975 USDA, Washington DC: <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRD3317283>
- Federal Seed Regulations: <http://www.gpo.gov/fdsys/pkg/CFR-2012-title7-vol3/pdf/CFR-2012-title7-vol3-part201.pdf>
- Canadian Seeds Act and Regulations, Canadian Food Inspection Agency, Ottawa: http://laws-lois.justice.gc.ca/eng/regulations/C.R.C.,_c._1400/index.html
- International Rules for Testing Seed: www.seedtest.org
- A good botany text:
 - *Botany in a Day*. Thomas J. Epel 5th ed.
 - *Botany Illustrated: Introduction to Plants, Major Groups, Flowering Plant Families*. J. Glimn-Lacy & P. B. Kaufman. 2006

Essential Material for Study in Preparation for the Purity Examination:

- Seed Technologist Training Manual. SCST (2001)
- Rules for Testing Seeds. Volumes 1 – 4. AOSA www.aosaseed.com
- Cultivar Purity Handbook. AOSA
- Rules & Regulations under Federal Seed Act. 2012 USDA, Washington DC: http://www.ams.usda.gov/lsg/seed/seed_pub.html
- Canadian Seeds Act and Regulations, Canadian Food Inspection Agency, Ottawa: http://laws-lois.justice.gc.ca/eng/regulations/C.R.C.,_c._1400/index.html
- International Rules for Testing Seed www.seedtest.org
- A good botany text:
 - *Botany in a Day*. Thomas J. Epel 5th ed.
 - *Botany Illustrated: Introduction to Plants, Major Groups, Flowering Plant Families*. J. Glimn-Lacy & P. B. Kaufman. 2006

Helpful material if copies can be obtained from any source. Most are out of print but may be checked out from the SCST Library.

- *Principles of Seed Science and Technology*. (4th edition, 2001) L.O. Copeland and M.B. McDonald.
- *Identification of Crop and Weed Seeds*. Agriculture Handbook #219 USDA, Washington, DC
- *Testing Agriculture and Vegetable Seeds*. Agriculture Handbook 30

Botany

Try to correlate your study of botany with your other studies concerning seed analysis. Study and review the chapter on Basic Botany for Seed Testing in the Seed Technologist Training Manual.

You will need a basic understanding of:

1. Classification of plants (Taxonomy)
2. Structure of seed plants
3. Vegetative parts of a seed plant:
 - a. Roots
 - b. Stems
 - c. Leaves
4. Reproductive parts of a seed plant:
 - a. Flower
 - b. Fruit
5. Study cell development
6. Follow with Dr. Copeland & Dr. McDonald's book *Principles of Seed Science and Technology* (4th Edition, 2001), Chapters 1, 2, and 3.
7. Definition of important terms (see Glossary of Terms, Appendix A)

Study of the Rules for Testing Seeds

Rules for Testing Seeds may be obtained from the AOSA Business Office. Complete knowledge of the Rules for Testing Seeds is of prime importance.

Purity

Study especially:

1. Sampling procedure.
2. Procedure for obtaining a working sample.
3. Weight of working sample. Working sample of mixtures.
4. Purity analysis.
5. Pure seed.
6. Weed seed.
7. Inert material.
8. Know how to calculate percentages of component parts of purity.
9. Familiarize yourself with the uniform blowing methods.
10. Special purity procedures.
11. Examination.
12. Tolerances - purity.

Viability

1. Study source of seed for germination.
2. Know definitions (i.e., concepts of dormancy).
3. Know the number of seeds needed for germination.
4. Learn evaluation of seedlings by family. You will notice seedlings of the same family will usually have the same evaluation.
5. Know when to retest.
6. Review the procedures of germination of common agriculture and vegetable seed. Learn to place them in groups according to temperature as Brassica require 20°-30°C most cereal require 20°C. Do not try to memorize, but rather familiarize yourself with the use of tables.

7. Understand the basic concepts of seed vigor.
8. Understand the processes involved in Tetrazolium testing.

Seed Collection (Minimum 150 kinds)

Each candidate for Registered Seed Technologist, Certified Purity Technologist, and Certified Seed Analyst in Purity is strongly encouraged to make a seed collection.

1. Any workable type of container may be used such as vials or small plastic packets.
2. Each kind should be labeled with the following information:
 - a. Genus, species, common name
 - b. Family
 - c. Origin/Source of seed
 - d. Date of collection or addition to collection
 - e. Category such as crop, weed, and indicate if noxious (this may change over time)
3. In making the collection, preference should be given to crop and vegetable seeds in general usage.
4. Noxious weed seeds occurring most frequently on the All-States and Canadian noxious weed seed list.
<http://www.ams.usda.gov/sites/default/files/media/NWS%20List%20for%202015.pdf>
<http://laws-lois.justice.gc.ca/eng/regulations/SOR-2005-220/index.html>
5. Kinds of seeds and crops easily confused.
6. Common weeds.

This collection should be of practical value in preparing for the identification portion of the examination. The more species you can include from the list of species that could be included in the exam, the more useful your collection will be. The collection is to be presented at the time of the examination and will be returned. A voucher from lab supervisor that the lab in which you work has a herbarium with at least 150 kinds of seed: common crops, federal and state noxious weeds is acceptable. The voucher form must describe how the herbarium is organized.

Identification of Seeds

If possible obtain Handbook 219 (can be borrowed from the SCST library) or use the seed plates in the Appendix of the SCST Seed Technologist Training Manual. Find a herbarium that contains the seeds you are required to know. This could be in your lab herbarium, a state or neighboring laboratory. There is a lending library of seed samples from the SCST. The Seedimages.com website is an excellent resource for a fee. Use as many resources as you possibly can in your studies.

Study your seeds by family classification and characteristics. Every seed has at least one unique characteristic - discover it and learn it. Every good analyst should know how to identify seeds by the use of keys. It is good practice to familiarize yourself with the keys used in Handbook #219.

Start by studying one family at a time. Poaceae is the largest group; it is a good idea to start with this one. The flash card system has worked well for some analysts: the seeds with the Latin name on one side and a few specific characteristics on the opposite side. You can do the same with good quality seed pictures in a top loading page protector. A good place to find some seed

pictures is the USDA Image Gallery website. <http://plants.usda.gov/gallery.html>

Set a goal to study and identify five or more different seeds every day. On the second day review those studied on the first day, continue with another five (or more) and so on through the week. Review all 25 (or more) at the end of the week. Repeat this procedure each week. At the end of two weeks review the seeds you've been studying. If you have forgotten any, keep reviewing them. Keep on studying and reviewing the ones you've learned until you have mastered the identification and have knowledge of many seeds.

Because it is so important to identify noxious weeds, you might prefer to start by studying the Federal Noxious, your State Noxious and other noxious weeds, then go on to the cereals, grasses, legumes, crops, vegetables, flowers, trees/shrubs, and weed seeds.

While you are learning identification, try to remember the botanical (Latin) name of seeds in your daily practice and laboratory procedures. A list of weeds, crops, vegetable/herbs, flowers, and tree/shrubs seeds is included. We advise you to separate the list into families rather than studying them alphabetically.

Know definitions describing seed characteristics and check the Uniform Classification of Weed and Crop Seeds, AOSA Rules Volume 3 for proper classification of seed.

See Appendix A for the link to the Seed Identification list found on AOSA and SCST websites, Appendix B for Acronyms and Appendix C for Definitions.

Special Studies

Viability

1. *Seed Vigor Testing Handbook* (Contribution No. 32, most recent edition)
 - a. Part One – The Importance of Seed Vigor Testing
 - b. Part Two – Variables and General Procedures in Vigor Testing
 - c. Part Three – Seed Vigor Tests - Principles
 - d. Part Four – Seed Vigor Tests - Procedures
2. Other Vigor References
 - a. AOSA Newsletter Vol. 51, No. 5. pp. 11-77, 14-21 and 42-51
 - b. Journal of Seed Technology Vol. 1, 1976, No. 2 Seed Vigor and Deterioration
3. Fluorescence Test for Ryegrass - *AOSA Rules for Testing Seeds*, current year's edition.
4. *Tetrazolium Testing Handbook* (Contribution No. 29, most recent edition.) Updates and copies are available from the AOSA website.
 - a. Study general procedures
 - b. Value of Tetrazolium testing
5. *Cultivar Purity Testing Handbook* (Contribution No. 33, most recent edition)

- a. Importance of cultivar identification
- b. Common cultivar purity tests: Seed Morphology, Quick Tests, Growth chamber tests
- c. Cultivar identification

Purity

1. Uniform Blowing Procedure - *AOSA Rules for Testing Seeds*, Volume 2.

Federal Seed Act

Acquaint yourself with the regulation so if you are asked any questions about the federal regulation you know where to find the answer.

Study the regulations on:

1. Interstate shipping
2. Importations
3. Certification
4. When to retest
5. Labeling date requirements

Acquaint yourself with the **Plant Variety Protection Act**.

Study your **State Seed Law** and recognize the difference between State and Federal enforcement.

Canadian Methods and Procedures for Testing Seed

Review the difference between labeling in Canada and in the United States. Know some of the Canadian prohibited noxious weed seeds, and the Canadian Weed Seeds Order. Familiarize yourself with the difference between AOSA procedures and the Canadian Methods and Procedures (M&P). Be able to explain the use of Canadian Grade Tables. The M&P can be found at:

http://www.seedanalysts.ca/assets/csaac_files/pdf/cfia/en/2016/mp/M&P%202016%20Edition%20English.pdf

International Seed Testing Association (ISTA) Rules for Seed Testing

Acquaint yourself with:

1. Rules for testing - note differences between ISTA and AOSA Rules.
 - a. Purity divisions
 - b. Seedling evaluation – i.e. Sunflower, tomato
 - c. TZ – 400 seed test
2. TZ Handbook
3. Areas covered by the ISTA Rules, including:
 - a. Sampling
 - b. Purity/Other seeds by Number
 - c. Germination
 - d. Cultivar
 - e. Vigor
 - f. Moisture

- g. Seed Health Testing
- 4. Use of Orange Seed Lot and Blue Sample Certificates
- 5. Accredited laboratories, including:
 - a. Proficiency testing
 - b. Audited every 3 years

Suggested Timeline for Preparing for the Exam

Set a goal for when you want to take the exam. If you have any questions during this process about requirements for the exam, you can direct questions to the SCST Executive Director, Teaching and Training Committee Chairs, or other analysts. Always remember- There are no stupid questions!

2 years out

- Make sure you have all the publications you will need to study.
- If you do not have a seed collection, begin to gather seeds from the SCST seed library http://www.seedtechnology.net/seed_library and the USDA Reserve Seed Collection.
Seed Regulatory and Testing Division
801 Summit Crossing Place, Suite C
Gastonia, North Carolina 28054-2193
Phone: (704) 810-8870
- Study basic botany
- Begin reading the *AOSA Rules for Testing Seeds* front to back.
- Read and work through the Seed Technologist Training Manual, photocopy the questions at the end of each chapter and practice writing out the answers.
- Read the Seedling Evaluation Handbook (*AOSA Rules for Testing Seeds*, Volume 4)
- Read the Cultivar Purity Handbook
- Read the Vigor Handbook
- Read the Moisture Testing Handbook
- Understand Handbook 25 (*AOSA Rules for Testing Seeds*, Volume 3) and how it is used.

1 year out

- Seed Identification: begin to learn the seed families. Focus on the main characteristics of the family and study each seed included on the exam. Start with studying single seeds then work on separations. Study five seeds per day, at the end of the week review all 25, at the end of the month review all the seeds you have learned. Once you have gone through all the seeds by family, begin quizzing yourself on randomly selected seeds.
- Germination: learn the characteristic of a normal seedling for each family. Identify the key characteristic for each family. Learn what makes a good seedling first will help you identify problem seedlings.
- Make vocabulary flash cards.
- Study each chapter of the Rules in depth. You should study one chapter every two weeks. Make a list of questions from each chapter and discuss these with another analyst. Call analysts outside your region if the questions are about crops with which you

are unfamiliar. If you need help finding someone to call, the Executive Director can help you find analysts with experience in different areas.

- Review the other Handbooks.
- Begin identifying differences between AOSA and ISTA Rules.
- Begin identifying key differences between AOSA Rules and Canadian M&P.

6 months out

Weekly written and practical quizzes:

- Practical germination quizzes should include categorizing seedlings as normal, abnormal, dead or hard. You should be able to explain your decision in 3-5 words.
- Written germination written quizzes should include:
 - Basic botany - ID flower and seed parts
 - Key family characteristics in seedling evaluation (is a primary root required?, for example)
 - When to retest
 - How to apply tolerances
 - Common germination procedures for different families
 - Where do the seeds for a germination test come from?
 - You should be able to write out and clearly explain the fluorescence test
 - What is a vigor test and how is it different from a germination exam?
- Practical purity quizzes should include seed identification, separations, and pure seed unit classification.
- Written Purity Quizzes should include:
 - How to obtain the working sample
 - Different types of mechanical dividers
 - Process for dividing a sample without a mechanical divider
 - Calculating test weights for species not in the rules
 - Mixtures
 - Pure seed unit questions
 - How to apply tolerances
 - Procedures for pelleted, encrusted or coated seeds
 - Uniform blowing procedure
 - Multiple floret calculations

3 months out

Evaluate your knowledge- use practice tests to identify the areas you need to focus on. The Teaching and Training Committee has collected practice quizzes. These can be downloaded from the website at: http://www.seedtechnology.net/teaching_training

- Daily seed identification and separation quizzes are useful.
- Continue weekly seedling evaluation quizzes.
- Practice writing the blowing procedure, multiple floret, and fluorescence test.
- Describe the basic cultivar purity tests and what they are used to determine.
- Describe the commonly used vigor tests and how they are used.
- Try to visit another lab or borrow a set of seed samples from another lab. By now you have memorized your samples and can probably identify them from across the room. You need to look at other seed samples in order to test your abilities.

- Seed sets can be borrowed from the SCST seed library.
- **4 weeks out**
- Focus studies on the areas you have problems with when taking practice quizzes.
- Continue to review seed identification.
- Review the rules and handbooks.

Hints for studying

Reading and writing are as important as seed identification and seedling evaluation. You not only need to understand the rules and handbooks, you need to be able to clearly express your understanding. This is why writing is stressed in this timeline. Most of us are not used to writing for an hour and half.

Even though you may use the Rules every day you must review the information and write answers to questions. A working knowledge of the Rules is very different from being able to express this information clearly on an exam.

Ask questions! There are many resources available to you and many people that are willing to help you succeed.

Test taking tips: What is the question asking?

It cannot be stressed enough how important it is to read a question slowly and fully during an examination to understand what is being asked. Full comprehension of the question begins with reading all parts of it to determine what is expected in an answer.

Read an entire question and then read it again. Make sure all the words are taken into account. Are you being asked to describe something, or are you being asked to describe its procedure? Read the question thoroughly so you understand what it is asking. If you do not understand the question, don't be afraid to ask the proctor to read the question to you with emphasis, or reword the question for you.

Interpreting a Question

The insertion of one simple word can change the content of a question and therefore the answer required. For instance, the following two questions have slightly different wording so would require two different answers:

Question 1: *How do you classify seeds with over half the embryo missing?*

Question 2: *How do you classify weed seeds with over half the embryo missing?*

Question 1 would require a two-part answer, as it is not specific to a classification of seed. Question 2 is specific in this manner. The answers, then, would be as follows:

Question 1: *How do you classify seeds with over half the embryo missing?*

A: For the kind being analyzed or other crop found in a purity working sample the size of the embryo is not relevant to its classification, the size of the seed is relevant. Larger than one-half seed is considered pure, and one-half or less is considered inert.

A: If it is a weed seed, you would classify it as inert.

Question 2: *How do you classify weed seeds with over half the embryo missing?*

A: You would classify it as inert.

These answers are complete, but can also be abbreviated as follows, giving the same answer:

Question 1: *How do you classify seeds with over half the embryo missing?*

A: If it's the kind being analyzed or other crop, size of embryo is not relevant but size of seed is.

A: Larger than one-half seed is pure, one-half or less is inert.

A: If it's a weed, inert.

Question 2: *How do you classify weed seeds with over half the embryo missing?*

A: Inert

Using Question 1 as an example, the same question can be asked in a number of different formats. Variations can include “*What do you call seeds with over half the embryo missing?*”, “*How do you call seeds with over half the embryo missing?*”, “*How would you classify seeds with over half the embryo missing?*” and “*In what category would you place a seed with over half the embryo missing?*” All of these questions are asking for the same answer.

Other questions will ask for a comparison, definition, description, process, procedure, or principle behind a specific topic or object. The definition of each of these terms follows.

Define, Describe or Explain

Define: To describe the nature or basic qualities of; explain: To state the precise meaning of (a word or sense of a word, for example).

Describe: To state the precise meaning of (a word or sense of a word, for example).

Explain: To make plain or comprehensible.

In general, these three words have similar use in a question: you are being asked to state the meaning of the something. However, if an exact definition is required, “define” is used.

Example:

Q: **Define** Uniform Blowing Procedure. OR

Q: What is the **Definition** of the Uniform Blowing Procedure?

A: *A standard purity procedure required for certain grass species that separates pure seed units from inert material using a seed blower.*

These words can be used alone, or in combination with procedure, process, and principle. If they are used with one of these three, it changes what is expected in the answer.

Procedure and Process, Principle, Purpose

For seed testing purposes, the definitions of these are as listed below:

- Procedure: A series of steps taken to accomplish an end.
- Process: A series of actions, changes, or functions bringing about a result.
- Principle: A basic or essential quality or element determining intrinsic nature or characteristic behavior; a rule or law concerning the functioning of natural phenomena or mechanical processes; a fixed or predetermined policy or mode of action.
- Purpose: the reason for which something is done or created or for which something exists.

Procedure and process, when used in a question, are referring to steps taken to accomplish a result. Principle, within a question, refers to the mode of action or how something works. Purpose refers to why you are doing something and what end result you expect to achieve by the action. Examples are below with varied question format, with both answers being correct for each question.

Q: *What is the **Procedure** for Uniform Blowing?*

Q: *Describe the step-by-step **Process** for the Uniform Blowing Procedure.*

Q: *Give the step-by-step **Procedure** for Uniform Blowing.*

Q: *What is the **Purpose** of the Uniform Blowing Procedure?*

A: *For samples with one kind of seed, the size of the sample to be blown shall be the same as that for the purity test except for blue grama and side-oats grama, which shall be divided into four approximately equal parts prior to blowing. All seed kinds are to be blown for 3 minutes. After completing the blowing procedure, remove all weed and crop seeds from the light portion and add these to the weed or crop separation, as appropriate. The remainder of the light portion shall be considered inert matter. Remove all weed and crop seeds and inert matter (stems, leaves, soil) from the heavy portion and add these to the weed, crop or inert matter separation as appropriate. The remainder of the heavy portion shall be considered pure seed.*

OR:

A: *Blown samples shall be the same size as the purity, except blue grama and side-oats grama which are divided into four equal parts before blowing. Remove large pieces, stem, hulls, etc., from sample before blowing. Use anemometer that is set to meters/second to check blowing point.*

Account for 'gate lag' by going below the blowing point and opening the gate to the blowing point.

Blow seed for 3 minutes.

Remove weed and crop from the light portion and place them in the appropriate purity separation component.

Place the remainder of the light portion in the inert component.

Remove all weed and crop seeds and inert matter from the heavy portion and place them in the appropriate purity separation component.

The remainder of the heavy portion shall be considered pure.

Q: What is the **Principle** of the Uniform Blowing Procedure?

Q: What is the **Principle** of a seed blower?

A: *In a seed blower, air is blown up through a sieve-bottom container and empty seeds and chaff are removed upwards through a tube. A collection bin is located at the end of the tube. Specific requirements such as air velocity setting and length of blowing time are stipulated for each species/kind of grass needing the uniform blowing procedure.*

OR:

A: *A vertical air stream is blown into a tube, separating components in a seed sample. Light particles are lifted and removed, while heavy particles remain within the tube. Specific blowing times and air velocity settings vary for each kind.*

Q: What is the **Purpose** of the Uniform Blowing Procedure?

Q: What is the **Purpose** of a seed blower?

A: *The Uniform Blowing Procedure is used for the separation of pure seed and inert matter in species as identified in the AOSA Rules for Testing Seeds.*

OR:

A: *To separate pure seed from inert matter.*

Comparison

A comparison question should include two items or topics of discussion. It is asking for the difference between the two. Using the definition of both can explain the difference, or use of just the difference will suffice. Example:

Q: *Compare germination and vigor as it relates to seed testing.*

A: *Germination is the emergence and development from the seed embryo of those essential structures which, for the kind of seed in question, are indicative of its ability to produce a normal plant under favorable conditions. On the other hand, vigor is a seed's potential for rapid, uniform emergence and development of normal seedlings under a wide range of field conditions.*

OR

A: Germination is the ability to produce a normal plant under favorable conditions, and vigor is the ability to produce a normal plant with uniform emergence under a wide range of field conditions.

Answering the Question Completely

Don't feel that you have to memorize everything. Just be aware of the key points; if you cannot determine what these are, ask your tutor, an RST/CPT/CVT, or a CSA. Their input can be most helpful. When you remember the key points, it is easy to complete an answer for the question asked by putting it in your own words.

For procedures, in general it is important to remember the action items and special conditions related to it:

Uniform Blowing Procedure:

1. Blown samples shall be the same size as the purity, except blue grama and side-oats grama which are divided into four equal parts before blowing.
2. Remove large pieces, stem, hulls, etc., from sample before blowing.
3. Use anemometer that is set to meters/second to check blowing point.
4. Account for "gate lag" by going below the blowing point and opening the gate to the blowing point.
5. Blow seed for 3 minutes.
6. Remove weed and crop from the light portion and place them in the appropriate purity separation component.
7. Place the remainder of the light portion in the inert component.
8. Remove all weed and crop seeds and inert matter from the heavy portion and place them in the appropriate purity separation component.
9. The remainder of the heavy portion shall be considered pure seed.

Key points for the step-by-step process for blowing seed are blow the whole purity sample but divide blue and side-oats grama in fourths; remove large particles; use anemometer and set blowing point accordingly; taking into account gate lag; blow 3 minutes; remove weed and crop seed from both portions; remove inert from heavy; light portion is inert and heavy is pure seed.

For definitions, key points are what make the definition unique from something similar.

Vigor: Those seed properties which determine the potential for rapid, uniform emergence and development of normal seedlings under a wide range of field conditions.

Key points for vigor are rapid uniform emergence; normal seedlings; wide range of conditions.

Germination: The emergence and development from the seed embryo of those essential structures which, for the kind of seed in question, are indicative of its ability to produce a

normal plant under favorable conditions.

Key points for germination are emergence and development from embryo; essential structures; normal seedling; favorable conditions.

In addition to key points, it is important to make sure that all parts of a question are answered. Watch for certain words such as “and” or a second sentence attached to the question. In some cases the first sentence may be making a statement of fact or clarification for the question that follows, and in some cases they are two separate questions. Read the question carefully to determine what is being asked. Some examples are as follows, with the first two questions requiring a two-part answer and the third question having an initial clarification statement.

Q: Give the step by-by-step Procedure for Uniform Blowing and list three species that use Uniform Blowing Procedures.

A: Uniform Blowing Procedure:

- 1. Blown samples shall be the same size as the purity, except blue grama and side-oats grama which are divided into four equal parts before blowing**
- 2. Remove large pieces, stem, hulls, etc., from sample before blowing**
- 3. Use anemometer that is set to meters/second to check blowing point**
- 4. Account for “gate lag” by going below the blowing point and opening the gate to the blowing point.**
- 5. Blow seed for 3 minutes**
- 6. Remove weed and crop from the light portion and place them in the appropriate purity separation component.**
- 7. Place the remainder of the light portion in the inert component**
- 8. Remove all weed and crop seeds and inert matter from the heavy portion and place them in the appropriate purity separation component.**
- 9. The remainder of the heavy portion shall be considered inert.**

Kentucky bluegrass, rough bluegrass, and Canada bluegrass

Q: For the kind being examined, how would seeds with over half the embryo missing affect the classification? What if it was a weed seed?

**A: For the kind being analyzed in a purity working sample, the size of the embryo does not affect the classification; the size of the seed does.
The size of the embryo affects the classification of the seed if it is a weed. You would classify it as inert.**

Q: The Uniform Blowing Procedure as described in the AOSA Rules for Testing Seeds shall be used for the separation of pure seed and inert matter. For which eight kinds of seed is it used?

A: Kentucky bluegrass, rough bluegrass, Canada bluegrass, weeping alkaligrass, Pensacola variety of bahiagrass, orchardgrass, blue grama, side-oats grama

Finally, make sure you know how to weight your studies. Look at the consolidated exam content sheet on the website: <http://www.aosaseed.com/exams> and see how the percentages of questions are distributed on the examinations. This information will assist you with making your studies more productive.

Workshops and Seed Schools

Throughout the year, workshops and seed schools are held across the country. Workshops are also held before and during the ASOA/SCST Annual meeting. Many offer hands-on training in purity, germination, vigor and Tetrazolium testing.

The following organizations hold regular seed schools:

Oregon State University: <http://seedlab.oregonstate.edu>/or contact seedlab@oregonstate.edu

Iowa State University: www.ag.iastate.edu/centers/seeds/Seeds.html

Federal Seed School: patsy.jackson@ams.usda.gov

Idaho Seed Analysts Association: Carolyn.Langley@agri.idaho.gov

Other labs may offer regional workshops. Please check the SCST and AOSA websites for current listings of upcoming workshops.

SCST Membership Privileges

Certificate of Membership

Presented to each registered member when accepted by the Society.

Name, Insignia, Seal, Seal Number, and Title Registered Seed Technologist

Name, Insignia, Seal, Seal Number, and title Registered Seed Technologist of the Society is a property-right and may be consigned, and use of same licensed, to active Registered Members ONLY, after execution of a signed *Privilege of Use Contract* to subscribe to such rules and professional ethics and regulations as set forth by the Constitution and By-laws, and upon deposit of a fee covering costs involved.

Dues

Dues are determined annually by the Executive Board, payable on or before May 1, or upon date of acceptance to membership. Current dues are \$350. Members may be suspended for delinquency of more than six months in payment of dues.

SCST Membership Maintenance

To maintain Registered or Certified Membership status each member shall meet one of the following Continuing Education requirements every three (3) years.

1. Attend a minimum of three (3) full days at the Annual Meeting of the Society, which includes attendance at the SCST business meeting. Registered or Certified Members present at the meeting but not in attendance during Roll Call are responsible for having their name recorded by the Secretary.

2. Attain five (5) points for attendance at workshops or seed schools directly related to seed testing that comprise a “hands-on” type program and have been approved prior to attendance by the Executive Director. Points are credited on the basis of one (1) point for every three (3) hours, maximum two (2) points per day. A certificate of attendance must be submitted to the Executive Director to receive proper point credits.
3. Attain five (5) points through individualized training outside the analyst’s regular work. The tutor/trainer must provide an agenda to the Executive Director prior to training and must include: dates and times of proposed training and content of training. Points are credited on the basis of one (1) point for every three (3) hours of training.
4. College credits from approved related courses would be acceptable for up to half (½) of required points based on three (3) points for each semester hour or two (2) points for each quarter hour.

Any active member failing to meet these requirements within two (2) years will receive written notice from the Executive Director that Registered or Certified Member maintenance requirements must be met within the next twelve (12) months. Failure to meet these requirements shall cause a Registered or Certified Member to become a Registered or Certified Member Inactive and lose Member’s rights and privileges. Upon receiving notice, the Registered or Certified Member Inactive shall return the Seal, if applicable, within thirty (30) days to the Executive Director.

Inspections

Inspections of applicant's laboratory equipment and reference materials, if deemed necessary by the Executive Director, will be made by a qualified SCST member or other Official so assigned, preferably from a location close to the applicant's laboratory to minimize expense, if any, for which the applicant shall be obligated.

SCST Registered Member Inactive

They shall include Members who are not presently employed in such capacity, are on leave of absence, are retired, or have failed to meet continuing education requirements, and/or delinquent in payment of dues. Registered or Certified Members Inactive (RMI) cannot vote, hold elective office or have use of Name, Insignia, Seal, Seal Number and title. Inactive members are entitled to all other privileges of the Society including a complimentary subscription to the Seed Technologist News for one (1) year if requested. Please contact the Executive Director if you wish to become inactive.

SCST Reinstatement

Application for reinstatement to Registered or Certified Technologist must be made in writing to the Executive Director and will become effective only upon verification of re-employment status, laboratory equipment/reference material inspection if applicable, proof of compliance for continuing education requirements (see below)*, and payment of all unpaid dues and assessments during any fiscal year, all to be approved by the Executive Director.

*Five points for each year inactive up to a maximum of 20 points or if an RMI has been

actively engaged in seed testing, they will be required to obtain only 2.5 points per year up to the maximum of 12 points.

AOSA Membership Maintenance

1. To maintain Certified Seed Analyst status, each analyst shall accumulate a minimum of five points every three years from the following continuing education categories:
 - a. A maximum of three points from verified attendance at qualified meetings:
 - (1) Attendance at the annual meeting of the Association. One point is obtained for each day of attendance, one of which shall include attendance at the business meeting.
 - (2) Attendance at a national, regional or local seed trade meeting. One half (1/2) point is obtained for each meeting attended.
 - b. One point for individual participation in a referee. An eligible referee shall consist of five or more participants from three or more laboratories and provide comparative results to the participant.
 - c. College credits for satisfactory completion of seed related courses, including distance learning courses, which have been approved by the Membership Chairperson or his/her designee, based on three points for each college credit. Evidence of attendance must be submitted to the Membership Chair or his/her designee to receive proper point credit.
 - d. One point for participation in a refereed proficiency test (SCST, ISTA, etc.) including satisfaction of any remedial measures. One half point for attendance at AOSA/SCST webinars.
 - e. One point for each half day (3 hours) attendance at a workshop or seed school directly related to seed testing that comprises at least a 50% "hands-on" type program and has been approved prior to attendance by the Membership Chairperson or his/her designee.
 - f. College credits for satisfactory completion of approved seed related courses, including distance-learning courses, based on three points for each semester hour or two (2) points for each quarter hour.
 - g. Individualized seed technology training from a CSA, an SCST Registered, Certified, or Research member, or a Canadian Accredited Seed Analyst that receives prior approval by the Membership Chairperson or his/her designee. Points are credited on the basis of one (1) point for every three (3) hours with a maximum of two (2) points per day. A certificate of attendance must be submitted to the Membership Chairperson or his/her designee to receive proper point credits.
 - h. One point annually for participation on the executive board as an officer or member.
 - i. One point annually for acting as chairperson of any recognized AOSA committee.
2. It is the responsibility of the member to present proof of earned points to the Membership Chairperson, or his/her designee, of the Association.
3. Any Certified Seed Analyst failing to meet these requirements within two (2) years will receive written notice from the Membership Chairperson or his/her designee that continuing education requirements must be met within the next 12 months. Failure to meet these requirements shall result in the loss of Certified Seed Analyst certification. Reinstatement of Certified seed Analyst may be accomplished by bringing the continuing education points up to date. (2007)

Re-examination Policy for AOSA/SCST

Policy Application

A passing score for each portion of the exam (Germination or Purity) is 70% minimum for the written and 80% minimum for the practical portions, with an overall average minimum of 80%.

1. Candidates who have taken all four sections of the AOSA/SCST exam during one examination period and who have failed only one written section (score is below 70 percent) or one practical section (score is below 80 percent), but have achieved an average score of 80 percent or above from all sections including the failed section, may retake the failed section not less than six months and not more than one year after the initial examination.

Note: Candidates who pass both germination portions of the exam are eligible for certification in germination (CVT or CSA – Germination). Such candidates must pass the germination written portion of the exam (minimum of 70%) as well as the germination practical (minimum of 80%), with an overall minimum of 80%. Example: If a candidate receives 70% on the written portion, he or she must receive a minimum of 90% on the practical portion in order to receive an overall passing score of 80%.

Similarly, candidates who pass both purity portions of the exam are eligible for certification in purity (CPT or CSA – Purity).

2. Candidates may choose to take only the germination sections of the exam in one examination session. Such candidates must pass both sections in order to be certified in Germination. If a candidate fails one of the two sections, he or she may retake the failed portion not less than six months and not more than one year after the initial examination.

The same policy applies to candidates who take only the Purity portions of the exam in one session.

If a candidate has previously been certified in one field (Germination or Purity), he or she need only take the portions of the exam pertaining to the certification in the other field (Germination or Purity) in order to become an RST or CSA – Germination and Purity.

Administering the Re-examination

The re-examination of the failed section shall be administered after six months but within one year of the initial exam at one of the regional exam sites unless extenuating circumstances prevent the candidate from taking the re-examination at that specific time (i.e. surgery, family emergency, etc.). Re-applications must be received within one year of the date of the failed exam.

If the re-examination of the failed section is not done after one year, the candidate must retake the entire exam. In the event the candidate is unable to retake the examination of the failed section at the specified time due to extenuating circumstances, an appropriate time and place to administer the re-examination will be selected by the Board of Examiners.

Reporting Examination Score

The score from the re-examination shall replace the existing score from the section failed on the initial examination. All other section scores from the initial examination shall be averaged with the new re-examination score. If the new average score of 80 percent or above is not achieved or the candidate once again fails the specified section, the entire AOSA/SCST examination must be retaken. The same is true for candidates retaking one section of the Germination or Purity exam.

Continuing Education Requirement

When the candidate fails the exam, they must reapply within one year of the date of the failed exam to the Executive Director. A candidate retaking any portion of the exam is required to earn five continuing education points in the area of the failed section before retaking the examination. Before retaking both portions of the exam, 10 points are required.

APPENDIX A. Seed Identification List

Seed Identification List: Revised 1/2013 (please see website)

http://www.seedtechnology.net/rst_cvt_cpt_exam/ or <http://www.aosaseed.com/exams>

APPENDIX B. Acronyms

- AASCO** **Association of American Seed Control Officials**
The Association of American Seed Control Officials is an organization of seed regulatory officials from the United States and Canada. Members meet annually to discuss mutual concerns of seed law enforcement, to be updated on new developments in the seed industry, and to update the Recommended Uniform States Seed Law (RUSSL) which the organization developed and maintains as a “model” law for states and federal programs.
(source: <http://www.seedcontrol.org/>)
- AMS** **Agricultural Marketing Service**
An office of the US Department of Agriculture which administers, in part, the Agricultural Marketing Act part 75. This act provides regulations for the inspection and certification of agricultural and vegetable seeds.
(source: <http://www.ecfr.gov/cgi-bin/text-idx?SID=f23667e74425f73d944275dc2dc34bcf&node=pt7.3.75&rgn=div5>)
- AOSA** **Association of Official Seed Analysts**
A seed testing organization formed in 1908 composed of seed analysts from official state, federal and university laboratories in the United States and Canada with a principal role of developing rules and procedures for seed testing and contributing to the standardization of seed testing.

(source: <http://www.aosaseed.com>)

- AOSCA** **Association of Official Seed Certifying Agencies**
AOSCA was formed in 1919 and is primarily composed of members from the United States and Canada with a primary function of providing an unbiased, service-oriented method for maintaining genetic identity of seed on the open market.
(source: http://www.aosca.org/Page/About_AOSCA.aspx?nt=85)
- APHIS** **Animal and Plant Health Inspection Service**
Agency of USDA which administers what was formerly Title III of the FSA regarding inspection of imported seed for noxious weeds. (source: http://www.aphis.usda.gov/plant_health/plant_pest_info/weeds/nwauthority.shtml)
- ASTA** **AMERICAN SEED TRADE ASSOCIATION**
A United States organization established in 1883 to represent the interests of the seed industry in lobbying for favorable legislation at the federal and state levels.
(source: <http://www.amseed.org/about-asta/who-we-are/>)
- CFIA** **Canadian Food Inspection Agency**
The Canadian counterpart to the US Department of Agriculture whose mission is to safeguard food, animals and plants, enhancing the health of Canada's people, environment, and economy. CFIA publishes the Canadian Methods and Procedures for Testing Seeds.
(source: <http://www.inspection.gc.ca/about-the-cfia/organizational-information/at-a-glance/eng/1358708199729/1358708306386>)
- CSA** **Certified Seed Analyst**
Certified affiliate member of an Association of Official Seed Analysts laboratory who has successfully qualified for and passed the combined RST/CSA exams in germination and purity.
(source: <http://www.aosaseed.com/about>)
- CSA-G** **Certified Seed Analyst in Germination**
Certified affiliate member of an Association of Official Seed Analysts laboratory who has successfully qualified for and passed the RST/CSA exam in germination.
(source: <http://www.aosaseed.com/about>)
- CSA-P** **Certified Seed Analyst in Purity**
Certified affiliate member of an Association of Official Seed Analysts laboratory who has successfully qualified for and passed the RST/CSA exam in purity.
(source: <http://www.aosaseed.com/about>)
- CSAAC** **Commercial Seed Analysts Association of Canada**
A group of Canadian Seed Analysts whose objectives are to enable themselves to keep abreast of changes and improvements in seed analyzing, as well as to

maintain and encourage the highest proficiency and professional standards among its members. Also, it assists members to solve problems arising in their work, and facilitates cooperation between Agriculture Canada, seed firms, and seed laboratories. (source: <http://www.seedanalysts.ca/>)

- CGT** **Certified Genetic Technologist**
A member of the Society of Commercial Seed Technologists who has passed one or two of the four genetic technology exams (PCR, ELISA, Electrophoresis and Herbicide Bioassay).
(source: <http://www.seedtechnology.net/membership>)
- CPT** **Certified Purity Technologist**
A member of the Society of Commercial Seed Technologists who is accredited in purity testing.
(source: <http://www.seedtechnology.net/membership>)
- CVT** **Certified Viability Technologist**
A member of the Society of Commercial Seed Technologists who is accredited in germination testing.
(source: <http://www.seedtechnology.net/membership>)
- ELISA** **Enzyme Linked Immunosorbent Assay**
A test that uses antibodies and color change to identify a substance. The purpose of an *ELISA* is to determine if a particular protein is present in a sample and if so, how much. (source: <http://en.wikipedia.org/wiki/ELISA>)
- EU** **European Union**
The EU is a single market of primarily European states, which has sought to guarantee the freedom of movement of people, goods, services and capital between member states. It maintains a common trade policy, *agricultural* and fisheries policies, and a regional development policy. (source: http://wikipedia.org/wiki/European_Union)
- FSA** **Federal Seed Act**
An act of the US government which regulates the interstate shipment of agricultural and vegetable seeds, requires that seed shipped in interstate commerce is labeled with information that is truthful and allows seed buyers to make informed choices, and helps promote uniformity among State laws. (source: <http://www.ams.usda.gov/rules-regulations/fsa>)
- GRIN** **Germplasm Resources Information Network**
A website maintained by the U.S. Department of Agriculture which provides germplasm information about plants, animals, microbes and invertebrates. This program is within the USDA's Agricultural Research Service. In 1990, the U.S. Congress authorized establishment of a National Genetic Resources Program (NGRP). It is the NGRP's responsibility to: acquire, characterize, preserve,

document, and distribute to scientists, germplasm of all lifeforms important for food and agricultural production. (source: <http://www.ars-grin.gov/>)

- ICBN** **International Code of Botanical Nomenclature**
Provides specific principles, rules and recommendations regarding scientific names of plants.
(source: <http://www.bgbm.org/IAPT/Nomenclature/Code/SaintLouis/0001ICSLCo ntents.htm>)
- IPSA** **Independent Professional Seed Association**
Formed in 1989 by a group of seed producers who recognized the need for an organization to represent the unique needs of independent seed companies.
(source: <http://www.independentseeds.com/index.cfm?show=10&mid=3>)
- ISF** **International Seed Federation**
A non-governmental, nonprofit organization representing the seed industry. It has members from over 70 developed and developing countries on all continents. ISF represents the mainstream of the world seed trade and plant breeder's community, and serves as an international forum where issues of interest to the world seed industry are discussed. (source: <http://www.worldseed.org>)
- ISTA** **International Seed Testing Association**
An international seed testing organization formed in 1924 to test and develop rules for seed testing on a global scale.
(source: <http://www.seedtest.org/en/home.html>)
- NASDA** **National Association of State Departments of Agriculture**
An organization of the Commissioners of Agriculture of the 50 states, that is comprised of a 10 member board whose purpose is to represent the state departments of agriculture in the development, implementation, and communication of sound public policy and programs which support and promote the American agricultural industry, while protecting consumers and the environment. (source: <http://www.nasda.org/About.aspx>)
- NGVRB** **National Grass Variety Review Board**
A review board of AOSCA that annually reviews applications for new grass varieties and publishes an updated list of ryegrass variety fluorescence levels twice a year. (source: <http://www.aosca.org/page/grass.aspx>)
- NIST** **National Institute of Standards and Technology**
An agency of the U.S. Department of Commerce's Technology Administration. It was established in 1901 and works with industry to develop and apply technology, measurements, and standards. NIST thermometers are used to calibrate seed laboratory test equipment.
(source: http://www.nist.gov/public_affairs/nandyou.cfm)

- OECD** **Organization for Economic Cooperation and Development**
An organization established in 1961 as an outgrowth of the European Economic Community. One of this organization's functions was to facilitate the certification of seed moving in international commerce.
(source: <http://en.wikipedia.org/wiki/OECD>)
- PCR** **Polymerase Chain Reaction**
A biochemical technology used to amplify a single copy or a few copies of a piece of DNA across several orders of magnitude, generating thousands to millions of copies of a particular DNA sequence.
(source: http://en.wikipedia.org/wiki/Polymerase_chain_reaction)
- PVPA** **Plant Variety Protection Act**
An act allowing for the protection of intellectual property rights of plant breeders who have developed new plant varieties. It is administered under AMS, USDA.
(source: <http://www.ams.usda.gov/services/plant-variety-protection>)
- RGT** **Registered Genetic Technologist**
A member of SCST actively involved in the field of genetic seed testing who has fulfilled the requirements for membership and passed three of the four genetic technology exams (PCR,ELISA, Electrophoresis and Herbicide Bioassay).
(source: <http://www.seedtechnology.net/membership>)
- RST** **Registered Seed Technologist**
A member of the Society of Commercial Seed Technologists who has fulfilled the requirements for membership, has passed the RST exam and is accredited in both purity and germination testing.
(source: <http://www.seedtechnology.net/membership>)
- RUSSL** **Recommended Uniform State Seed Law**
A model law to promote uniformity in state and federal seed legislation with representative contributors from AOSA, AASCO, AASCA, ASTA, and others.
(source: <http://www.oisc.purdue.edu/seed/pdf/russl.pdf>)
- SCST** **Society of Commercial Seed Technologists**
This society is an organization comprised of commercial, independent and government seed technologists. It was formed in 1922 and functioned as a liaison between the AOSA and ASTA. Today it also trains and provides accreditation to seed technologists, as well as researches and develops changes to the AOSA *Rules for Testing Seeds*.
(source: <http://www.seedtechnology.net/>)
- TFL** **Test Fluorescence Level**
In ryegrass, a test used in determining the pure seed percentage of perennial ryegrass and annual ryegrass, by growing 400 seeds on white filter paper and

determining the number of fluorescent seedlings under ultraviolet light at the end of the germination period.

(source: http://www.ecfr.gov/cgi-bin/text-idx?SID=ff2947b6ef50dc5f0fdd8103bc1b2e62&mc=true&node=se7.3.201_158a&rgn=div8)

Title V

Title V of the Plant Variety Protection Act

A provision of the Plant Variety Protection Act allowing a variety protected under PVP to be sold only as a class of certified seed. It refers only to those varieties with PVP certificates that have been chosen to be sold only as a class of certified seed.

(source: <http://www.ams.usda.gov/services/plant-variety-protection>)

UGS

Undesirable Grass Seeds

Seeds of ten grass species deemed undesirable in seven eastern states (MD, VA, WV, PA, NJ, NH and DE). These species are bentgrass, bermudagrass, annual bluegrass, rough bluegrass, meadow fescue, tall fescue, orchardgrass, redtop, timothy, and velvetgrass. When marketing turf varieties into the listed states, the seed label must list the name and number per pound or ounce of UGS species found in a test sample under the heading "Noxious Weed Seed" or "Undesirable Grass Seed."

(source: <http://seedlab.oregonstate.edu/testing-purity>)

UPOV

International Union for Protection of New Varieties of Plants

Intergovernmental organization of Plant Variety Protection agencies of 72 countries. UPOV's mission is to provide and promote an effective system of plant variety protection, with the aim of encouraging the development of new varieties of plants, for the benefit of society.

(source: <http://www.upov.int/portal/index.html.en>)

VFL

Variety Fluorescence Level

A way of describing for identification purposes annual and perennial grass varieties due to the percent of fluorescent seedlings shown under ultraviolet light. See TFL.

(source: http://www.ecfr.gov/cgi-bin/text-idx?SID=ff2947b6ef50dc5f0fdd8103bc1b2e62&mc=true&node=se7.3.201_158a&rgn=div8)

APPENDIX C. Definitions

Abnormal seedling. A seedling that does not have all the essential structures or is damaged, deformed or decayed to such an extent that normal development is prevented; a seedling that cannot be classified as normal (see Normal seedling).

Absorption. The uptake of moisture into tissue of an organism (e.g., seed.)

Accelerated aging test. A type of stress test that exposes seeds to high temperatures and high relative humidity for a set period prior to evaluation of seed vigor potential.

Accessory fruit. A fruit, or collection of fruits, whose fleshy parts are derived mostly from tissues other than the ovary.

Accessory structures. In seed testing: structures other than the seed and fruit.

Achene. A dry, hard, one-chambered, one-seeded indehiscent fruit (as in buckwheat, sunflower and spinach), with the seed attached to the fruit wall at a single point.

Adventitious root. A root arising from any structure other than a root.

Aeration. (n) an aerating or being aerated. Aerate (v) = to expose to air; cause air to circulate through; to charge (liquid) with gas, as in making soda water; in agriculture, to expose (soils) to the action of the air by plowing, harrowing, etc.

Albino. A seedling that is white and has no chlorophyll development. It is considered as an abnormal seedling in germination tests conducted in accordance with AOSA rules. A seedling in which all tissues are white due to the absence of pigments.

Aleurone. Granules of protein and enzymes usually occurring in the outermost layer of the endosperm.

Aleurone layer. Outermost layer of endosperm in cereals and many other taxa that contains protein bodies and enzymes concerned with endosperm digestion.

Androecium. The collective term for the stamens in a flower.

Angiosperm. A plant whose seeds are borne within a mature ovary (fruit).

Annual. A type of plant that normally starts from a seed, produces flowers, fruits and seeds, and then dies within one growing season.

Anther. The pollen-bearing portion of a stamen.

Anthesis. The opening of the flower bud exposing the reproductive organs.

Apical meristem. Growing point at the tip of the root and stem in vascular plants (see Meristem).

Apomixis. The formation of an embryo without meiosis and/or the fusion of gametes.

Aril. A fleshy outgrowth of the ovule or funiculus.

Axis. The main stem of an embryo or plant.

Awn. A slender appendage, an extension of a dorsal and sometimes lateral vascular bundle that projects from the lemma and/or glumes in grasses.

Basal. At the base or bottom.

Biennial. A type of plant that produces only vegetative growth during its first growing season; flowers, fruits and seeds are produced during the second growing period, after which the plant dies.

Binomial nomenclature. The scientific method of naming species, using Latin (see Scientific name).

Biochemical tests. Vigor tests that evaluate the efficiency of biological or physiological functions of seeds.

Blowing point calibration sample. A prepared colored seed sample composed of a heavy and light fraction that are of different colors used to establish a blowing point prior to proceeding with the uniform blowing procedure.

Bract. In angiosperms: A small or rudimentary leaf or leaf-like structure near the base of a flower or inflorescence.

Bracteole. A small bract subtending a flower or fruit.

Bulblet. A small bulb; an aerial bulblike structure, usually borne in the axil of a leaf or bract.

Bulk examination. An examination conducted to determine the occurrence of particular components in the sample. The component may be seeds of individual species or particles of certain types of inert material (e.g., ergot or soil).

Callus. A thickened layer at the base of a grass floret.

Calyx. The collective term for the sepals of a flower.

Capacitance seed moisture meters. The most common indirect seed moisture testing devices that expose hydrogen water molecule atoms to high frequency electrical waves. The strength of the absorption of the waves by the hydrogen atoms identifies the amount of water in the seed.

Capillary bristles. A type of pappus with very slender bristles.

Capitulum. A small head inflorescence.

Capsule. A dry fruit of two or more carpels, usually dehiscent by valves.

Carpel. In angiosperms, a modified leaf producing one or more ovules.

Carpophore. A slender extension of the receptacle between the two carpels of the fruits in some species of the Apiaceae or carrot family.

Caruncle. A hardened aril.

Caryopsis. A dry, one-seeded, indehiscent fruit or grain of the grass family (Poaceae) with the fruit wall (pericarp) fused to the seed coat (testa).

Chaffy seed. Seed units that adhere to other seed units or other surfaces because of their structure or texture, making it difficult to sample a seed lot or mix and divide a representative working sample (not applicable to coated/pelleted/encrusted or dehulled seeds).

Chalaza. The region of the ovule opposite the micropyle where the nucellus and integuments fuse with the funiculus.

Chalcid. Any of various tiny wasps of the superfamily Chalidoidea, some of whose larvae feed inside seed.

Chlorophyll. A pigment found in chloroplasts that gives plants their green color, vital to the process of photosynthesis.

Chromosome. A structure within the nucleus of a cell in higher plants bearing genetic information.

Cilia (pl.). Fine hair-like or projections.

Ciliate. Having a fringe of fine hair-like projections along the margin.

Circumscissile. Opening all around by a transverse split.

Coated seed. See Encrusted seed, Pelleted seed.

Cold test. A type of stress test that exposes seeds to cold, wet conditions, sometimes in the presence of soil containing naturally occurring soil pathogens. Following a set period of cold stress, seeds are transferred to warm conditions, allowed to germinate, and germination percentage is counted.

Coleoptile. The sheath enclosing the terminal bud of the embryo and the developing leaves of the young seedling of the grass family (Poaceae).

Coleorhiza. The sheath enclosing the radicle of the grass embryo.

Complete flower. A flower (floret) having all four whorls of floral parts (e.g., sepals, petals, stamens, carpels).

Concave. Hollow and curving inward, bowl-shaped.

Conducting tissues. Tissues that transport water and dissolved minerals from the root to the other plant structures, and foods from where they are manufactured (e.g. leaves) to where they are needed for growth or storage.

Conductivity test. A type of biochemical test where a specific number of seeds are weighed and seeds are soaked in distilled or deionized water for 24 hours. The electrical conductivity of the soak water is determined as a measure of seed vigor.

Controlled deterioration. A type of stress test used mainly for small seeded crops. Seeds are preconditioned to a specific moisture and sealed in foil packets which are submerged in a high temperature water bath for a specific length of time prior to evaluation of germination as a measure of seed vigor.

Convex. Curving outward as the surface of a sphere.

Cool germination test. A type of stress test used for mainly for cotton. Germination is evaluated at 18°C as a measure of seed vigor.

Corolla. The collective term for the petals of a flower.

Corymb. A raceme with the lower flower stalks longer than those above, so that all the flowers are at the same level.

Cotyledon. The modified storage leaf or pair of leaves of an embryo and seedling (see primary leaf).

Cultivar. A variety or pure line of a species that has been selected through breeding for specific traits.

Cyme. An inflorescence; a convex or flat flower cluster, the central flowers unfolding first.

Dead seeds. Seeds which at the end of the test period are neither hard nor dormant nor have produced any part of a seedling.

Decay. Break-down of organic tissue, usually associated with the presence of micro-organisms.

Dehiscent fruit. A fruit that opens at maturity allowing seeds to be released from the fruit.

Dicotyledon. A term used to describe a group of angiosperms characterized by embryos having two cotyledons. Also called dicot. (See Monocotyledon).

Dimorphic. An object having two forms.

Dioecious. A species having male and female structures on separate plants.

Diploid. Having a double set of homologous chromosomes (indicated by 2N).

Direct seed moisture tests. Tests in which water is removed from the seed by various means and the amount lost determined quantitatively.

Diseased. Showing symptoms of the presence and activity of pathological or detrimental micro-organisms.

Dormancy. A physical or physiological condition of a viable seed that prevents germination even in the presence of otherwise favorable conditions.

Dormant seeds. Viable seeds, other than hard seeds, which fail to germinate when provided the specified germination conditions for the kind of seed in question.

Dorsal. Back or outward facing surface of a part or organ in relation to the central axis.

Drupe. An indehiscent fruit with a fleshy or pulpy outer part and a bone-like inner part; a single-seeded fleshy fruit.

Drupelet. A small drupe, as one section of a blackberry.

Eciliate. Without cilia or hairs.

Elaiosome. A specialized oil-containing aril.

Electrophoresis. A technique used to separate a mixture of proteins or DNA base on their electric charges and molecule size.

Elliptic. Oval-shaped.

Embryo. A rudimentary plant contained in a seed, usually consisting of a more or less differentiated axis and attached cotyledon(s).

Embryo excision test. Excising the embryo from the seed coat and associated structures that often impose dormancy to permit germination. Often used as a viability test for dormant tree and shrub seeds.

Embryo sac. In angiosperms, the female gametophyte, usually seven celled and eight nucleate, and consisting of the egg cell, two synergids, three antipodals and a bi-nucleate central cell.

Embryonic axis. The main stem of the embryo.

Encrusted seed. Seed that has been covered by a layer(s) of materials that obscure the original shape and size of the seed resulting in a substantial weight increase. The coating or encrusting may contain biologicals, identifying colorants or dyes, pesticides, polymers and/or other ingredients. See Pelleted seed.

Endocarp. The innermost layer(s) of the pericarp (fruit wall).

Endosperm. In angiosperms, the nutritive tissue formed following the fusion of the second male gamete and the polar nuclei of the central cell of the embryo sac. Nutritive tissue originating from fertilization and retained at maturity in some seeds as storage for food reserves.

Epicotyl. The upper portion of the axis of an embryo or seedling above the point where the cotyledon(s), are attached, consisting of the epicotyl stem, the developing leaves, and the terminal bud.

Epigeal germination. A type of germination in which cotyledons are carried above soil level by the elongating hypocotyl (see Hypogeal germination).

Ergot. Dark spur-shaped fungal body that develops in place of a healthy seed in a diseased inflorescence.

Essential structure. Structure which is critical for continued development of the seedling into a plant.

Etiolation. Phenomenon exhibited by green plants when grown in darkness. Such plants are pale yellow, their stems exceptionally long and their leaves reduced in size.

Exogenous. A dormancy breaking treatment originating from outside the seed, as in laboratory application of gibberellic acid.

Fascicle. In grasses: A group of spikelets subtended by bristles.

Female gametophyte. The nutritive tissue in seeds of gymnosperms. It develops without fertilization, therefore it is sometimes called primary endosperm.

Fertilization. The fusion of two gametes resulting in the formation of a zygote.

Field emergence. The establishment of seedlings in the field.

Filament. The stalk of an anther.

Film coated seeds. Film-coated seed retains the shape and the general size of the raw seed with a minimal weight gain. The film coating may contain biologicals, identifying colorants or dyes, pesticides, polymers and/or other ingredients.

Flora. A list of plants growing in a defined geographic region.

Floret. General: An individual flower within a cluster. In grasses: A flower usually enclosed by two bracts (lemma and palea).

Flower. The reproductive structure in angiosperms.

Fluorescence test. A test commonly used to distinguish cultivars of oat and ryegrass in which fluorescent coloration of seed coverings or seedling root is observed when viewed under ultra-violet light.

Follicle. A many-seeded dry fruit, derived from a single carpel, and splitting longitudinally down one side.

Formazan. The water-insoluble red compound produced when dehydrogenase enzymes in seeds are exposed to Tetrazolium solution (TZ).

Fruit. In angiosperms, a mature ripened ovary, usually containing seed(s).

Fruiting bract: A small or rudimentary leaf or leaf-like structure near the base of a fruit that may or may not enclose the fruit.

Funicular remnant. A piece of funiculus remaining attached to the seed.

Funiculus. The stalk that connects the seed (ovule) to the fruit (ovary) wall.

Fusifiform. Broadest at the middle and tapering towards each end.

Gamete. A haploid reproductive cell; during sexual reproduction two gametes fuse to form a diploid zygote.

Geotropism. Plant growth response to gravity.

Germination. (AOSA definition) In seed testing, the emergence and development from the seed embryo of those essential structures which, for the kind of seed in question, are indicative of its ability to produce a normal plant under favorable conditions.

Germination. (physiological definition) A process involving water uptake, metabolic changes and cell elongation resulting in radicle emergence from the seed.

Gibberellic acid (GA₃). A growth hormone, one of over 50 gibberellins. First discovered in the fungus *Gibberella fujikuroi*. Found in highest concentrations in immature seeds. Can be used to substitute for dormancy-breaking cold and light requirements in many species.

Gibberellins. Growth hormones that stimulate cell division and cell elongation.

Glabrous. Without hairs.

Glumes. The bract(s) subtending the floret(s) or at the base of a spikelet in most grasses.

GMO. Genetically modified organism.

Growth hormone. A chemical compound generally produced in one part of an organism and transported to another part of the organism where it controls or affects growth and development.

Guaiacol. A chemical used in the peroxidase seed coat test on soybeans.

Gymnosperm. A plant whose seeds are not borne within an ovary.

Gynoecium. The collective term for the carpels in a flower.

Haploid. Having a single set of homologous chromosomes (indicated by 1N).

Hard seeds. Seeds which remain hard at the end of the prescribed test period because they have not absorbed water due to an impermeable seed coat.

Head. A dense inflorescence of sessile or nearly sessile flowers, as in Asteraceae.

Herbarium. A collection of preserved (usually dried) plant specimens used for scientific study.

Herbicide trait. A trait incorporated into a cultivar that provides tolerance to an herbicide that

is normally toxic to that cultivar and/or crop species.

Hilum (hila, pl.). A scar on a seed indicating the point of funicular attachment. In grasses, the mark on the caryopsis indicating the point of attachment of the seed to the pericarp.

Hirsute. Having moderately coarse and stiff hairs.

Hispid. With bristle-like hairs.

Hypanthium. A cup-shaped structure surrounding the ovary, derived either from the fusion of floral parts or an extension of the receptacle to which the floral parts are attached.

Hypocotyl. The part of the embryo or seedling axis between the cotyledons and the radicle (above the primary root and below the cotyledons).

Hypocotyl collar rot. A physiological breakdown of hypocotyl tissue caused by calcium deficiency.

Hypogeal germination. A type of germination in which the cotyledon(s) or comparable structure (e.g. scutellum) remain in the soil (see epigeal germination).

Imbibition. Water uptake by a seed.

Imbibition damage. Crushing of seed tissues by rapid and uneven swelling of surrounding tissues during imbibition.

Impaired. Unable to function normally, in reference to damaged seedling structures.

Imperfect. A flower (floret) lacking either male or female reproductive structures.

Incomplete. A flower (floret) lacking at least one whorl of floral parts (e.g., sepals, petals, stamens, carpels).

Indehiscent. Remaining closed at maturity.

Indehiscent fruit. A fruit that does not split open naturally at maturity to release the seeds.

Indirect seed moisture tests. Tests in which a chemical or physical characteristic of the seed is measured that is related to moisture content.

Indoxyl acetate test. A rapid seed soak method used to reveal cracks in the seed coats of legume seeds utilizing indoxyl acetate and ammonia resulting in a purple staining of damaged areas.

Inert matter. That component of the purity test that includes all material not classified as seed in one of the other component parts (pure seed, other crop seed, or weed seed).

Infection. Entrance and spread of disease organisms in living material (e.g. seedling structures) often causing disease symptoms and decay.

Inferior ovary. An ovary completely or partially surrounded by floral parts or embedded in receptacle tissue.

Inflorescence. A cluster of florets arranged in a definite pattern.

Inhibitor. A chemical substance that retards or prevents germination.

Inner membrane. A complex tissue derived from seed testa and endosperm found in seeds in the family Asteraceae. The site of impermeability to water and gases in this group. This

membrane is sensitive to temperature when hydrated, and is the site of phytochrome responses to light.

Inoculated seed. Seed which has received a coating of a preparation containing a microbial product e.g. *Rhizobium* sp.

Integument. The outer layer(s) of tissue surrounding the nucellus of an ovule that becomes the seed coat.

Internode. The part of a stem between two nodes.

Involucre. A whorl of distinct or united leaves or bracts subtending a flower or an inflorescence.

Keel. A projecting ridge.

Kind. One or more related species or subspecies that singularly or collectively are known by one common name.

Lesion. A term used to describe a wound or damaged tissue.

Legume. A dry fruit consisting of one carpel, splitting by two longitudinal sutures with a row of seeds on the inner side of the central suture; pod, as in Fabaceae.

Lemma. The lower of two bracts that subtend a grass flower in most grasses.

Lens. A protuberance, usually located on the side of the hilum opposite the micropyle in some Fabaceae seed.

Lenticular. Shaped like a double convex lens as in lentil beans.

Linear. A long and narrow organ with the sides nearly parallel.

Lobed. Divided to about the middle or less.

Locule. The cavity with an ovary containing the ovules.

Locus (loci, plural). The position that a gene occupies in a chromosome.

Lodicules. Scale-like structures in a grass flower that swell and force open the surrounding structures to facilitate pollination.

Meiosis. A type of nuclear division in which a single diploid nucleus undergoes a reduction division to form four haploid nuclei. This process may be followed by cytokinesis resulting in four haploid cells.

Mericarp. A segment from a schizocarpic fruit.

Meristem. Plant tissue composed of undifferentiated cells that initiate cell division.

Mesocarp. The middle layer of the pericarp (fruit wall) between the endocarp and exocarp.

Mesocotyl. In some highly specialized monocotyledons (e.g. certain Poaceae) the part of the seedling between the scutellar node and the coleoptile.

Micropyle. An opening in the integument(s) through which the pollen tube usually enters the ovule.

Microspores. A haploid spore that develops into a male gametophyte in heterosporous plants.

Mitosis. A type of nuclear division in which the chromosomes are duplicated then separated to form two identical daughter nuclei. This process may be followed by cytokinesis resulting in two identical cells.

Mixture. A seed sample consisting of more than one kind or cultivar, each present in excess of 5 percent of the whole. Under certain circumstances pure seed units of kinds and/or cultivars present to the extent of 5% or less of the whole could be specified as part of the pure seed component and therefore part of a mixture.

Monocotylar. An embryo with only one cotyledon.

Monocotyledon. A term used to describe a group of angiosperms characterized by embryos having one cotyledon. Also called monocot. (See Dicotyledon.)

Monoecious. A species having separate male and female flowers or cones on the same plant.

Morphological dormancy. Seed dormancy due to immaturity of the embryo.

Morphology. The study of form and structure of an organism.

Morphophysiological dormancy. Dormancy combining embryo immaturity and physiological dormancy.

Multiple fruit. A fruit derived from an inflorescence, a combination of gynoecia from many flowers.

Multiple unit procedure. A purity procedure used to determine the amount of inert material in spikelets and florets that do not disarticulate in certain prescribed grasses by means of a mathematical factor method. (See Appendix G for example)

Necrosis. Dead or deteriorating seedling tissue, which may be caused by injury, disease or physiological breakdown.

Negative geotropism. Growth in opposition to gravity; upward growth of roots and downward growth of stem. (see Geotropism).

Nematode. Member of a phylum of microscopic worms, many of which are parasitic to plants and animals.

Nerves. Ribs or veins in the chaffy structures of grass or seed pods.

Normal seedling. A seedling with all essential structures present and capable of developing into a plant under favorable conditions; certain defects may be present if they are judged to be not so severe as to impede further development of the plant (see Abnormal seedling).

Noxious weed seed examination. An examination to determine the number of seeds, bulblets, or tubers of individual noxious weeds per unit weight.

Noxious weed seed working sample. A prescribed amount of sample by weight on which the noxious weed examination is performed.

Nucellus. The tissue of the inner part of an ovule in which the embryo sac develops; it may persist as nutritive tissue in some seeds (see Perisperm).

Nucleic acid assay. Method of examining DNA to analyze for specific sequences (alleles) in genes; used as an aid to identify types of ryegrass seeds/seedlings.

Nut. A hard, dry, indehiscent fruit, usually single-seeded.

Nutlet. A dry, one-seeded portion of a fruit that fragments at maturity; found in the Boraginaceae, Lamiaceae, and Verbenaceae families.

Obcordate. Inversely heart-shaped, with attachment at the point.

Oblanceolate. Inversely lanceolate, attached at the narrow end.

Oblique. Slanted or with asymmetrical sides.

Oblong. Much longer than wide, with nearly parallel sides.

Obovate. Inversely ovate, attached at the narrow end.

Obtuse. Blunt or rounded at the apex.

Orbicular. Nearly circular in outline.

Other crop. That component of the purity test that includes pure seed units of plants grown as crops, other than the kind(s) or cultivar(s) included in the pure seed component.

Oval. Broadly elliptic.

Ovary. The lower part of a single carpel or group of fused carpels (compound pistil) containing the ovule(s).

Ovate. Egg-shaped, with the point of attachment at the broad end.

Oven test method. The most popular direct seed moisture test in which a quantity of seed is weighed prior to and after drying in an oven at a prescribed temperature for a specified time and the loss in weight is calculated as percentage moisture content on a fresh or dry weight basis.

Ovule. In seed-bearing plants, a structure comprised of an egg-bearing female gametophyte surrounded by the nucellus and one or two integuments. At maturity the ovule becomes a seed.

Paired tests. Samples tested both with and without prechill or other treatments prescribed for breaking dormancy.

Palea. The uppermost of two bracts subtending a grass flower.

Panicle. An inflorescence, a branched raceme, with each branch bearing a raceme of flowers, usually of pyramidal form.

Pappus. A ring of fine hairs developed from the calyx, covering the fruit, as in Asteraceae; acting as a parachute for wind-dispersal, as in dandelion.

Pedicel. The stalk of a floret in an inflorescence or of a grass spikelet.

Pedicellate. A structure borne on a pedicel.

Peduncle. The stalk of a solitary flower or an inflorescence.

Pelleted seed. Seed that has been covered by a layer(s) of material(s) that obscures the original shape and size of the seed, resulting in a substantial weight increase, with the objective of enhancing precision planting and accurate placement of the seed in the soil by mechanical planters. See Encrusted seed.

Perennial. Plant that continues its growth from year to year.

Perfect. A flower (floret) having both male and female structures.

Perianth. A collective term for the sepals and petals (calyx and corolla) of a flower.

Pericarp. The fruit wall; derived from the ovary wall.

Perisperm. Nutritive tissue occurring within certain seeds (e.g. *Beta*), derived from the nucellus; similar in function to endosperm.

Peroxidase. An enzyme found in the seed coats of soybeans.

Peroxidase Test. A soybean seed coat soak method used to determine peroxidase activity levels that may be used to confirm cultivar purity.

Petals. The second whorl of floral parts, usually conspicuously colored, collectively known as the corolla.

Petiole. The stalk of a leaf.

Phloem. The type of conducting tissue that transports synthesized food through a plant.

Photosynthesis. Process in which energy of sunlight is used by green plants to build complex substances from carbon dioxide and water.

Physical dormancy. A type of dormancy due to the impermeability of seed (or fruit).

Physiological dormancy. Seed dormancy caused by internal physiological conditions that prevent germination.

Physiological quality. The biological functions and activities associated with seed germination, seed health, and seed vigor.

Physiology (seed). The study of the metabolic activities and processes of seeds.

Phytotoxic. Poisonous to plants.

Pigmentation. A coloration of tissues which can be used to distinguish cultivars, an example would be green or purple hypocotyls in soybean seedlings.

Pilose. Having scattered, simple, moderately stiff hairs.

Pistil. The female reproductive structure in angiosperms consisting of an ovary, style, and stigma, derived either from a single carpel or group of fused carpels.

Pistillate. Female-flowered, flower lacking stamens.

Placenta. The part of the ovary wall where the ovules develop and remain attached until maturity.

Placentation. The arrangement of ovules within the ovary.

Plano-convex. An object that is flat on one side and curving outward on the other side.

Plant propagules. A plant part that reproduces a plant, such as seed, fruit, bulbil, bulblet, bulb, corm, tuber, rhizome, floret, spikelet, etc.

Plumose. Feathery; as an axis with fine hairs or bristles on both sides.

Plumule. That part of the embryonic axis above the cotyledons.

Pollen. Collective term for pollen grains.

Pollen grain. In seed-bearing plants, a microspore containing an immature or mature male gametophyte (microgametophyte).

Pollen tube. The tube that extends from the pollen grain into the ovule carrying the male gametes to the female gametophyte.

Pollination. In angiosperms, the transfer of pollen from the anther to the stigma. In gymnosperms, the transfer of pollen from the pollen-producing (male) cone to the ovules of the ovulate (female) cone.

Polycotyledony. The normal production of more than two cotyledons in an embryo.

Polymorphic. An object having many forms.

Potassium nitrate (KNO₃). A chemical used as a dormancy breaking agent by increasing membrane permeability. In animal research, potassium increases membrane permeability and sodium decreases membrane permeability. The nitrate increases stem elongation and shortens roots.

Prechill. A cold, moist treatment applied to seed to overcome dormancy prior to the germination test.

Predry. To place the seed in a shallow layer at a temperature of 35 to 40°C for five to seven days, with provision for circulation of the air, prior to the germination test.

Primary infection. Infection caused by disease organisms present and active in the seed and/or seedling itself (see Secondary infection).

Primary leaf. The first leaf or leaves above the cotyledon(s).

Primary root. Main root of the seedling, developing from the radicle of the embryo.

Puberulent. With very short hairs; woolly.

Pubescent. Covered with short, soft hairs.

Punctate. Covered with colored dots, or sessile or embedded transparent glands, or minute depressions.

Pure Live Seed (PLS). The percentage of pure seeds in a seed lot that have the ability to germinate. The percentage of PLS is determined by multiplying percent total viable by percent pure seed and dividing by 100.

Pure seed. That component of the purity test that includes all the pure seed units of each kind and/or cultivar under consideration which are present in excess of 5% of the whole. Under certain circumstances pure seed units of kinds and/or cultivars present to the extent of 5% or less of the whole may be considered part of pure seed component.

Pure seed percentage. The percentage by weight of the pure seed units in the purity working sample.

Pure seed unit. A seed unit that conforms to the complex criteria for pure seed of the kind and/or cultivar under consideration in seed testing rules. (See Appendix G for example)

Purity test. An analysis to determine the percentage composition by weight of the sample being tested and the identity of contaminating species and inert material.

Purity working sample. A prescribed sample weight on which the purity test is performed.

Pyrene. The hard, indehiscent, one-seeded portion of a drupe or drupelet (stone or pit).

Quality system. Documented policies, programs, procedures and instructions set in place to the extent necessary to assure the quality of laboratory test results.

Quiescence. The absence of growth, usually inferring the absence of environmental conditions favoring growth.

Raceme. An inflorescence, with the main axis bearing stalked flowers, these opening from the base upward.

Racemose. Like a raceme or in a raceme.

Rachilla. The main axis of a grass or sedge spikelet.

Rachis. The main axis of an inflorescence (or compound leaf).

Radicle. The rudimentary root of the embryo, developing into the primary root after emergence from the seed.

Rame. A disarticulating inflorescence branch that forms the basic unit of a typical Andropogoneae (a tribe in the grass family) inflorescence.

Rame internode. A segment of an inflorescence branch in the Andropogoneae.

Raphe. A ridge on the seed surface formed by the part of the funiculus that is sharply bent at the base of the ovule and fused to the ovule.

Raw seed. A seed that is free of any applied materials.

Receptacle. The portion of the flower stalk that bears the floral parts.

Recommended vigor test. Tests that for the listed species, have been rigorously evaluated through recognized protocols including extensive referee testing and many comparisons to emergence performance.

Reniform. Kidney-shaped, usually attached at the center of the incurved side.

Respiration. The metabolic process by which an organism takes in oxygen and releases carbon dioxide and other products of oxidation.

Reticulate. Covered with net-like lines.

Reticulation. A raised surface area resembling a network or mesh.

Root hair. Fine tubular growth from an epidermal cell of a root.

Rudimentary embryos. Embryos that are small, immature and sometimes undifferentiated at the time of seed release from the parent plant.

Samara. A dry, indehiscent fruit, with a wing-like extension of the pericarp.

Sarcotesta. A fleshy seed coat.

Scabrous. Having a surface covered with short stiff hairs; scurfy or rough.

Scale leaf. A reduced leaf, usually appressed to the stem (e.g. in *Asparagus*, *Pisum*).

Scarification. The process of mechanically or chemically abrading a seed coat to make it more

permeable to water and gases to hasten germination.

Schizocarp. A dry fruit that splits up at maturity into one-seeded segments (mericarps), as in the carrot family.

Schizocarpic fruit. A dry simple fruit with two or more united carpels that split apart at maturity.

Scientific name. The recognized Latin name given to an organism, consisting of a genus and species, according to a taxonomy; also called binomial name.

Sclerotia (pl.). Compact, dormant mass of fungus hyphae usually with a black outer surface and white inner mass.

Scutellum. The cotyledon of a grass embryo, specialized in absorption of endosperm. A shield shaped cotyledonary structure in the embryo of grasses (Poaceae) that absorbs nutrients from the endosperm and provides energy for germination.

Secondary dormancy. A type of dormancy imposed by certain adverse environmental conditions in previously nondormant seeds, or seeds in which primary dormancy has been broken.

Secondary infection. Infection caused by disease organisms spreading from other seeds or seedlings or adhering structures (e.g. the cluster of *Beta*) (see Primary infection).

Secondary root. Any root other than primary, seminal or adventitious roots.

Seed. The mature fertilized ovule of a seed-bearing plant.

Seed blower. A mechanical device utilizing a vertical air stream in a tube to aid in the separation of components in a seed sample.

Seed coat. The outer layer of a seed usually derived from the integument(s). Also called testa.

Seed coverings. Accessory structures such as bracts, fruit walls, and floral parts.

Seed deterioration. A progressive reduction in performance capabilities, including reductions in the rate and uniformity of germination, reduced tolerance to environmental stresses and inferior seedling emergence and growth, brought about by natural or artificial aging or injury of the seed.

Seed herbarium. A reference collection of preserved seeds, fruits, and other plant propagules used for scientific study.

Seed unit. The structure usually regarded as a seed in planting practices and in commercial channels. The seed unit may consist of a true seed with or without adherent structures (see also True seed).

Seed vigor. Those seed properties that determine the potential for rapid, uniform emergence and development of normal seedlings under a wide range of field conditions.

Seedling. A young plant developing from the embryo of a seed.

Seedling growth tests. Vigor tests that measure speed and uniformity in seed germination or seedling growth.

Seminal roots. Roots that arise from the embryo; roots arising from the scutellar node in

Poaceae.

Sepals. The outer most whorl of floral parts, collectively known as the calyx.

Sessile. A structure lacking a stalk and directly attached by the base to another structure.

Shoot. A collective term including all structures above the root in epigeal species and above the cotyledonary node in hypogeal species. In the Poaceae, all structures above the scutellar node are included, i.e. the mesocotyl, coleoptile and leaves.

Silicle. Similar to a silique, but short and broad, never more than four times as long as broad as in Brassicaceae.

Silique. A dry elongated fruit divided by a partition (septum) between the two carpels into two sections as in Brassicaceae.

Simple fruit. A fruit derived from a single carpel or several fused carpels.

Sinus. A depression or notch in a margin between two lobes.

Sodium hypochlorite test. A rapid seed soak method for soybeans to reveal cracked seed coats in which damaged seeds swell 2 to 3 times their original size.

Sperm nuclei. Two nuclei which migrate down the pollen tube to fertilize the female gamete and the polar nuclei within the embryo sac.

Spike. An elongated inflorescence with sessile or nearly sessile flowers.

Spikelet. One or more attached grass florets usually subtended by one more bracts (glumes).

Spindly. Disproportionately thin relative to length; thread-like in appearance.

Spore. In seed plants, the spore is the first cell of the gametophyte generation. The two kinds, microspore and megaspore, produce male and female gametes, respectively.

Stamen. The male reproductive organ in an angiosperm composed of an anther and a filament.

Staminate. Male-flowered, lacking female reproductive organs.

Standard Operating Procedures (SOP). A detailed written description of methods and materials used in a process, usually part of a quality or accreditation system.

Stem. The above ground axis of a plant which bears the leaves, flowers, and true buds, as well as anatomically similar portions below ground (e.g. rhizomes and corms).

Stigma. The receptive surface of a carpel (pistil) upon which pollen grains adhere and germinate.

Stramineous. Straw-colored.

Stratification. A method of overcoming seed dormancy; seeds are placed in a moist medium and exposed to either cold or warm temperatures, depending on the required treatment for the species involved.

Stress tests. Vigor tests that expose seeds to environmental stress prior to or during the germination process.

Stubby root. Blunt, broken off or dwarfed.

Style. The columnar portion of a pistil connecting the stigma to the apex of the ovary and through which the pollen tube grows.

Subglobose. Nearly globe-shaped.

Subspheroid. Nearly sphere-shaped.

Swollen seeds. Seeds which have imbibed water, but which do not show radicle or shoot protrusion.

Synergids. In angiosperms, the two cells adjacent to the egg at the micropylar end of the embryo sac.

Terminal bud. The shoot apex (apical meristem of the epicotyl) enveloped by several more or less differentiated leaves.

Test fluorescence. The percentage determined by dividing the number of normal seedlings with fluorescent root traces (when observed under ultra violet light) by the total number of normal seedlings in a fluorescence test of ryegrass.

Testa. Seed coat; the covering structure of a true seed, derived from the integument(s).

Tetrazolium chloride (TZ). Water soluble colorless chemical used to determine viability of seeds. In respiring tissues, dehydrogenase enzymes reduce TZ to form a water insoluble reddish compound, formazan.

Thyrse. A densely branched inflorescence, with the main branching racemose but the lateral branching cymose; a compound panicle.

Tolerance. The amount by which a second test may differ from a first test without being attributed to an actual difference in seed quality.

Total viability. The sum of the percentage of germination plus dormant plus hard seed.

Treated seed. Seed with a minimal covering of various materials whose primary objective is to reduce or control certain disease organisms, insects or other pests attacking the seed or seedlings growing therefrom and which contains identifying colorants or dyes.

Trigonous. Triangular in cross-section.

Triple fusion. The combination of one sperm nucleus and two polar nuclei (each 1N in number) resulting in a 3N nucleus.

True seed. A mature fertilized ovule consisting of an embryo, with or without an external food reserve (e.g. endosperm) enclosed by the testa.

Truncate. Squared-off at the apex or base.

Tube nucleus. Nucleus which migrates down the pollen tube but does not enter the embryo sac.

Tuberculate. Covered with small rounded bumps.

Turgid. Swollen.

Umbel. A raceme in which the axis has not changed, so the flower stalks arise at the same point, as in Apiaceae.

Uniform Blowing Procedure. A standard purity procedure required for certain grass species that separates pure seed units from inert material using a seed blower.

Utricle. A dry, thin-walled, one-seeded, bladder-like fruit.

Varietal Purity. An examination to determine the extent to which the seed sample conforms to the stated cultivar.

Vascular tissues. Seed conducting tissues.

Veins. Strands of vascular tissue visible from the surface of plant structures.

Ventral. Front or inward surface of an organ in relation to the central axis.

Vernacular name. Common name.

Viable (viability). Alive. Seed viability indicates that a seed contains structures and substances including enzyme systems that give it the capacity to germinate under favorable conditions in the absence of dormancy.

Vigor. AOSA definition: “Those seed properties which determine the potential for rapid uniform emergency and development of normal seedlings under a wide range of field conditions.” The speed and uniformity of germination, especially under unfavorable conditions.

Villous. Covered with long, soft, somewhat wavy hairs.

Weed seed. That component of the purity test that includes seeds, florets, bulblets, tubers, or sporocarps of plants recognized as weeds by laws, official regulations, or by general usage and conforms to the complex criteria in the Rules for weed seed units.

Xylem. The type of conducting tissue that transports water and mineral salts through a plant.

Zygote. The diploid cell resulting from the fusion of the male and female gametes.

APPENDIX D. Instructions for Tutorial Program

If there are any questions pertaining to the tutorial program, or tutorial forms, please contact the Executive Director.

Society of Commercial Seed Technologists (SCST)
653 Constitution Ave NE
Washington, DC 20002
(202) 870-2412
www.seedtechnology.net

SECTION I: SUGGESTIONS FOR A TUTORIAL PROGRAM

Object:

To help applicants obtain points for taking the AOSA/SCST examination.

The following are considered qualified supervisors or tutors:

- Registered Member of the Society of Commercial Seed Technologists;
- Supervisor of a member laboratory of the Association of Official Seed Analysts.
- Senior Member of the Commercial Seed Analysts of Canada.
- Supervisor of a government laboratory of an International Seed Testing Association member country.

The tutorial program should not be a crash program to help applicants pass the AOSA/SCST examination. Rather it should be a well outlined program that will extend through at least two years.

Orientation:

It is beneficial if the tutor and trainee meet at the beginning of the program and plan in detail what they hope to accomplish over the course of their studies. Keep in mind quarterly reports will need to be sent to the executive director. The structure of the two organizations should be gone over with the student. Current events in the societies should be shared. A good way to do this is to frequent the AOSA and SCST websites. Participation in the regional referees are good ways to keep up-to-date with issues in the society and will also meet the requirement of participating in referees (two are required). It is also advantageous for the tutor to visit the trainee's laboratory to see what facilities are available. This would be similar to a laboratory inspection and would help the tutor better tailor their teaching to meet the student's needs.

Purity:

The Rules should be studied and the tutor should make up questions to be answered. Practice exams are available on the AOSA and SCST websites to help augment the tutor's questions. Learn about equipment both old and new, emphasizing equipment that will be given as practical portions of the exam, such as the various dividing devices and the uniform blowers. Purity exam samples of seed should be made for the trainee to work. At least one sample every two weeks should be given and reviewed between the student and tutor. Review how to report results with the trainee.

Identification of some of the seeds listed in Appendix A should be done every week. Learn the characteristics of seeds according to family. A herbarium should be started. (A collection of 150 kinds is required for the student to have before taking the exam.) Identification should not be

taken for granted as that is a critical part of seed technology.

Germination:

Study normal and abnormal seedlings as defined in Volume 4 of the AOSA Rules for Testing Seed. Learn the difference between monocotyledon and dicotyledon seedlings. The seedlings in each family bear similarities. Abnormal seedlings from practice germination tests should be ~~noted~~ categorized as well as determined what caused the abnormality. Practice samples should be sent to the candidate and the results ~~recorded~~ compared to the know germination percentage of the samples. Students should learn about when to use different germ temperatures and methods for germination, about different substrata used in germination tests, and how to properly report germination percentages.

Special Studies:

Study tolerances (purity, noxious weed, germination and vigor) in the Rules and work out problems pertaining to them.

Vigor Testing:

Use *Seed Vigor Testing Handbook*, Contribution No. 32. Work on vigor would be best in the tutor's lab.

Tetrazolium Testing

Study the *Tetrazolium Testing Handbook*, Contribution No. 29. Practice cutting, staining and evaluating seeds for TZ tests.

Cultivar Purity Testing:

Use *Cultivar Purity Testing Handbook*, Contribution No. 33. Learn importance of cultivar identification, the PVP Act, and types of tests.

Blowing Procedure: Know how and why a blower is calibrated. Be able to demonstrate how one would be used when testing certain grass species. Study at tutor's lab or at accredited seed school or workshop when one is not available on site.

Fluorescence Tests: Study how to calculate fluorescence level on ryegrass. Study at tutor's lab or at accredited seed school or workshop if ryegrass is not tested on site.

Grass Multiple Florets: Study what is a multiple unit in grass seed and what species are indicated in the multiple seed unit factors. Be able to calculate purity exam results when a multiple seed unit factor is required.

Referee projects:

Participating in referees from various regions of the United States provide valuable experience in seed testing. Referees are usually conducted to research seed identification and germination problems.

Reading:

Reading is a vital part of the training of an analyst. The tutor should encourage the trainee to read. Some of the books or pamphlets may or may not be in print. These older books are a good source for the foundation or beginning of seed testing information. The SCST Library contains many of these books. The tutor may check out copies for the person they are tutoring by contacting:

Brent Reschly

brent.reschly@syngenta.com

Syngenta Seeds, Inc.

1524 South Bell Ave., Suite 102

Ames, Iowa 50010 USA

Phone: 515-663-6102

Fax: 515-232-4469

It is **strongly suggested** that the tutor program follow closely the *SCST Seed Technologist Training Manual*. The *SCST Seed Technologist Training Manual* is an essential study tool in which to work from during the training program. It is thorough and is very useful in following a good study format. It may be obtained from the Executive Director.

A trainee should not only read the subscribed material that is of value to them but also make a report to show the knowledge gained. The *Rules for Testing Seed* published by the Association of Official Seed Analysts (AOSA), is the best source of seed testing information.

A well-trained analyst should also be familiar with the basics of the Canadian Methods and Procedures (M&P) for Testing Seed and the International Seed Testing Association's *International Rules for Seed Testing*. These may be obtained on line from:

Canadian M&P: <http://www.seedanalysts.ca/cfia-updates/cfia-upd-en/>

ISTA: http://www.seedtest.org/en/international-rules-_content---1--1083.html

Suggested Reading:

Testing Agricultural and Vegetable Seeds, Agriculture Handbook 30

Identification of Crop and Weed Seeds, Agriculture Handbook 219

Handbook for Seedling Evaluation, ISTA.

Seed Identification Manual, A.C. Martin and W.D. Barkley, 1961

Seed Testing: Principles and Practices, 2012. Sabry G. Elias (Editor), Lawrence O. Copeland (Editor) Miller B. McDonald (Editor), Riad Z. Baalbaki (Editor), Chapter V, Seed Viability and Viability Testing, pp. 103-120

Principles of Seed, Science, and Technology, L.O. Copeland, 1976.

Seed Purity & Taxonomy, Doris Baxter and Larry O. Copeland, 2008.

SECTION II: Tutor's Responsibility to a Trainee

The tutor's ultimate responsibility to the tutorial student is that sufficient information be presented in the appropriate manner so that the student passes the RST exam. It is also imperative that the student not only be able to pass the exam but that they arrive on the other side of the tutorial with the ability and desire to be a well-rounded, informed, and curious analyst, one who desires to continue to learn and grow as a professional. The tutorial program is certainly an appropriate place for the concepts of analyst ethics to be introduced and emphasized. Being a mentor as well as a tutor would be ideal.

As a tutor there is no small investment of time and self. One is willing to take on the responsibilities of being a tutor because others have taken the time to impart skills and knowledge to us. It is “payback time” so to speak. But... it is not just a one way street of giving time and energy. If the tutor is open to the situation, the tutorial is an excellent way to brush up on rusty skills and little used knowledge! The student, the analyst and the SCST as a whole benefits from commitment to the tutorial program.

The following is a more detailed list of suggested responsibilities of the tutor. This list is meant as a guide to some of the major areas that must be covered with the student for successful completion of the tutorial. It is also a look at the time involved in a tutorial program.

- A. The tutor needs to plan ahead and make sure the student is on track. The student is on track. The student needs to be thoroughly aware of what the tutorial program involves. For instance, estimated hours of study each week/month, the fact that they must keep track of hours and what was studied and fill out a quarterly report, the time frame for completing the tutorial, and the March 1st deadline for submitting an application for the exam, all these details should be explained by the tutor so there are no misunderstandings. Two calendars could be filled out, one for you and one for the student and tutor. There is a lot of documentation and paper work that is part of the requirements for the tutorial and exam and the tutor must make sure that the student is able to provide what is needed and that it is sent in on time.
2. The employer for the student should be aware of the time needed for the student to study. Costs to the tutor for their time and expertise need to be clear. This is particularly true if the employer is different for the tutor and student. A simple contract should be signed stating estimated hours, costs, and anticipated time frame for the tutorial to be completed. Keep a detailed log of your time spent to prepare tutorial materials, costs of copying, mailing, faxing etc.
3. The student needs to make a list for the tutor of available books, equipment, herbarium samples, and so on. If there are areas lacking then the tutor needs to let the student know as soon as possible what needs to be purchased or borrowed so that study can proceed as planned. The tutor needs to keep the student within the timetable agreed upon.
4. The tutor will need to prepare written tests for the student on purity and germination rules. Instead of starting from scratch, ask other RSTs who have had students and try to beg or borrow study tests. These are very important for the student so that they can become familiar with test taking and gain a feel for what the exam is like. It raises confidence levels and will point out problem areas to you both. It opens up dialogue about the rules. Respond in a timely manner. First tests can be “open Rules Book”, an excellent way for student to become familiar with location of specific rules. Later the test should be given to test retention of information. A tutor cannot over emphasize the exactness of the wording of the rules and definitions and how the Rules apply to daily seed testing.

5. Hands-on purities, seed identification, and germination evaluations are a must. If the tutorial is through the mail, sample packets should be prepared and sent on a regular basis. These packets take an incredible amount of time to prepare the first time through. (Make sure the student knows they are your samples and that you need them back for next time.) You may want to make seed available for the student to make their own study sets and for herbarium samples. Seeds can be sent for germination tests. Two weeks a year the student needs to be in your lab. Allow for this in a slow period, and as time allows dedicate this time to learning!
6. As a tutor you are responsible for answering all questions of the student. Usually the student needs to search out the answer for themselves, but often you'll need to assist. Be prepared that if you don't know the answer, to get the answer from someone who does. (Remember this is a learning experience for you too!) Tutors are not experts in all areas of seed testing. If you can, set up study with another RST who has more knowledge in a specific area other than your own. Exposure to other analysts, labs, techniques, is invaluable, especially if the student tests a limited number of species in their lab.
7. Make sure the student gets to an annual meeting and to at least one workshop a year. Encourage participation in any local seed groups.
8. Students have many different styles of learning. Some knowledge of different styles would be helpful. Prepare materials that suit your student. Some students will have experience with test taking and know how to study for tests. Others will have great anxiety over the test portion and confidence will need to be encouraged in this area.

Each tutorial situation and student will be different. The above suggestions are from my one experience with the tutorial. It was a tutorial through the mail and the student had a very solid seed science background so we didn't have to cover the basics of botany, physiology etc.

Flexibility, the desire to educate, and patience are most helpful! May you find many personal and professional rewards as a tutor.

Jane Hall, RST 10/95

On Being an Effective Tutor

1. The first thing to consider is the time commitment involved in tutoring another analyst. This is not a role to take lightly. The tutor needs to put in many hours for preparation of materials and follow-up. This is in addition to the time spent with the trainee.
2. We always start an analyst with "good" material. We don't start talking about abnormal; we start by having the trainee handle lots of 99% strong sprouts.
3. The same is true of purity materials. We select excellent examples of seed to use in training. Later we add off-colors or shapes, but at first use clear materials.
4. We have the trainee start by reading the Rules, front to back. No attempt is made to memorize passages. After they have read through the Rules and we have answered

questions, they read them again, and again, and again. Each time they read the Rules, they see something different. As the time approaches before the exam, they are reading the Rules every night.

5. As we start learning germination abnormalities, we start by reading the passage from the Rules. We define the terms, look at illustrations and then talk about the seedlings. We have the trainee make an independent decision first (what would you call it, and why?) and then discuss the Rules again.
6. When starting on purity, we again start with clean samples. We gradually add simple to find, common weeds. We start with the federally listed noxious weeds; then move on to the most common noxious weeds. Gradually we add look-alikes or closely related seeds that may be confusing. We have a set of seeds labeled 1 - 400. We use these in training, and later, gradually use them in quizzes.
7. We have the trainee work through the training manual working on one section each week including reading all the recommended material. If there are questions they are discussed. The trainee writes out the answers and submits them for review. (This ends up being his/her own study materials for later.)
8. As the spring approaches for the RST exam, we begin giving weekly and then daily quizzes. These are straight ID's (timed 5 min. only) and a simple mixture (simple to start with then harder, with repeats on the ones that are giving them trouble.) We start with groups of similar or related seeds. The quizzes are turned in, checked and the ones missed are reviewed more carefully.
9. The same process is followed for germination. Samples of 10 seedlings are pulled and given as a quiz. Then we go over the answers and discuss the rules and illustrations. We start with the most common problems for a crop then work to the more difficult problems. If we don't usually test the seed, we buy seed from a nursery or health food store or spice department and germinate them.
10. The last month the trainees are left to review the prepared materials and work on the more difficult separations. By then they have gone through the entire training manual and are reviewing. They usually have lots of questions each day at this stage.
11. A lot of what we do as tutors is help make the material make sense and give trainees the help and encouragement they need.

Nancy Vivrette, RST, Research Member

1/96

SECTION III: Tutorial Program Form

To receive points for a tutorial program the following must be completed during a 12 month period:

1. Quarterly reports (13 complete weeks) must be filed with the Executive Director within 2 weeks after completion of quarter. All requirements on the quarterly reports must be completed. One point is given for each 160 hours unsupervised testing experience in purity and germination verifiable by employer and by a qualified tutor.
2. Two referee projects must be completed. It is not necessary to report the results to the referee chairman, but they should be checked to determine if testing is accurate.
3. At least two weeks (10 days) per year must be under the direct supervision of the tutor.
4. Secondary tutors are acceptable if authorized by primary tutor.

Tutor's signature

Date

Student's signature

Date

Employer's signature

Date

Must be signed and dated at beginning of Tutorial Training and returned to the Executive Director.

SECTION IV: Verification of Tutored Seed Testing Experience Form

Quarterly Report

Please type or use black ink.

13 complete weeks represent 1 quarter.

This report must be filed with the Executive Director within 2 weeks after completion of quarter.

Name _____ Telephone _____

Address _____ Zip _____

Employed by _____ Telephone _____

Office Address _____ Zip _____

Email address _____

NAME OF TUTOR: _____

Check appropriate qualification of tutor:

- Registered member of the Society of Commercial Seed Technologists.
- Supervisor of a member laboratory of the Association of Official Seed Analysts.
- Senior member of the Commercial Seed Analysts Association of Canada.
- Supervisor of a government laboratory of an ISTA member country.

Date of Tutorial Supervision: _____

From: mm/dd/yyyy To: mm/dd/yyyy

Days under direct supervision of Tutor: 2 weeks (10 days) per year required.

Dates		Laboratory
From:	To:	
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Quarter Program

- 1. Purity: A minimum of 10 projects must be completed.
- 2. Germination: A minimum of 10 projects must be completed.
- 3. Identification: As agreed between student and tutor.
- 4. Reading Assignments: A minimum of 300 pages.
- 5. Examination: A minimum of 1.
- 6. Other: _____

To the best of my knowledge, this student has completed the above assigned projects.

Tutor's Signature _____
Date

The above assignments have been completed.

Student's Signature _____
Date

Employer's Signature _____
Date

For Executive Director use only: Approved _____ Not Approved _____

Remarks: _____

APPENDIX E. Membership Contracts

Sample RST Contract

**FOR PRIVILEGED USE OF NAME, SEAL, SEAL NUMBER, AND TITLE
REGISTERED SEED TECHNOLOGISTS (or acronym RST) OF
THE SOCIETY OF COMMERCIAL SEED TECHNOLOGISTS, INC.**

This Contract is made by and between the Society of Commercial Seed Technologists, Inc.

(hereinafter Society), _____ Employee Seed Technologist

(hereinafter Technologist), and _____ (hereinafter Employer).

RECITALS

WHEREAS, Technologist wishes to have Privileged Use of the Name, Insignia, Seal, and Seal Number of the Society of Commercial Seed Technologists, Inc., and the title: Registered Seed Technologist (or acronym RST) of the Society; and

WHEREAS, Employer wishes to have the Society issue such Privileged Use of Name, Insignia, Seal, and Seal Number of the Society of Commercial Seed Technologists, Inc., and the title; Registered Seed Technologist (or acronym RST) to the Technologist, for benefit of both Technologist and Employer; and

WHEREAS, Technologist and Employer understand and agree with the importance of maintaining the integrity of said Name, Insignia, Seal, and Seal Number of the Society of Commercial Seed Technologists, Inc., and the title: Registered Seed Technologist (or acronym RST) of the Society, and agree to use every effort to maintain same; and

WHEREAS, Technologist and Employer agree that such integrity would be undermined if the Name, Insignia, Seal, and Seal Number of the Society of Commercial Seed Technologists, Inc., and the title: Registered Seed Technologist (or acronym RST) of the Society were employed on analysis reports, correspondence, or publications containing false, misleading, inaccurate, incomplete, or plagiarized information. Both Technologist and Employer further agree that the Society would be damaged by such misuse of said Name, Insignia, Seal, and Seal Number and the title: Registered Seed Technologist (or acronym RST).

NOW, THEREFORE, IT IS AGREED AS FOLLOWS

- A. That the Society shall issue Privileged Use of Name, Insignia, Seal, Seal Number, and the title: Registered Seed Technologist (or acronym RST) for the following uses, pursuant to the following terms:
1. Report of Analysis
 - a. that said Name, Insignia, Seal, and Seal Number of the Society of Commercial Seed Technologists, Inc., and the title: Registered Seed Technologist (or acronym RST) will be used only in reporting results from seed analysis done by, or under the direct supervision of the Technologist;
 - b. that said Name, Insignia, Seal, and Seal Number of the Society of Commercial Seed

Technologists, Inc., and the title: Registered Seed Technologist (or acronym RST) are to be used to show association only with the Technologists; that said Seal will be used only over the authorized signature of the Technologist; that said Name, Insignia, Seal, and Seal Number of the Society of Commercial Seed Technologists, Inc., and the title: Registered Seed Technologist (or acronym RST) will not be used on a Report of Analysis containing false, misleading, inaccurate, incomplete, or plagiarized information.

2. Correspondence

- a. that said Name, Insignia, Seal Number and title Registered Seed Technologist (or acronym RST) may be used in association with the signature of the Technologist on any appropriate business and/or professional correspondence which does not contain false, misleading, inaccurate, or plagiarized information;
- b. that said Seal Number will always accompany the use of the Name, Insignia, and the title Registered Seed Technologist (or acronym RST).

3. Publications

- a. that said Name, Insignia, Seal Number and title Registered Seed Technologist (or acronym RST) may be used by Technologist and Employer in publications to promote the professionalism of their business or laboratory, if said publications do not contain false, misleading, inaccurate, or plagiarized information;
- b. that said Seal Number will always accompany the use of the Name, Insignia, and title Registered Seed Technologist (or acronym RST).

- B. That the Privileged Use of said Name, Insignia, Seal, and Seal Number of the Society of Commercial Seed Technologists, Inc., and the title: Registered Seed Technologist (or acronym RST) will be canceled in the event of the death or change of employment of the Technologist, or the Technologist becoming a Registered Member Inactive.
- C. That said Seal may not be copied or duplicated.
- D. That Technologists will remit, on demand; the sum of \$ 75 established as a use fee for said Seal and will maintain said Seal in proper operating order hence forth.
- E. That the said Name, Insignia, Seal, and Seal Number of the Society of Commercial Seed Technologists, Inc., and the title: Registered Seed Technologist (or acronym RST) shall remain the property of said Society.
- F. That Technologist and Employer will comply with all terms of this contract concerning the proper use of said Name, Insignia, Seal, and Seal Number of the Society of Commercial Seed Technologists, Inc., and the title: Registered Seed Technologist (or acronym RST) of the Society, and furthermore will comply with any additional requirements as are currently now in effect, or as hereafter may be reasonably adopted in furtherance of the purposes of the Society in the Constitution, By-laws, or Executive Board Policy of said Society.
- G. That in the event a Grievance Committee is appointed to investigate misuse of said Name,

Insignia, Seal, and Seal Number of the Society of Commercial Seed Technologists, Inc., and the title: Registered Seed Technologists (or acronym RST) of the Society, all records bearing on such case will be made available, and to this end the Technologist and Employer will cooperate and abide by whatever actions deemed appropriate according to the Constitution and By-laws of said Society.

FURTHERMORE:

- H. That said Technologist will actively participate in Society affairs including committee assignments, obligations of elective office, and will comply with continuing education requirements as defined in the By-laws i.e., attendance at annual conventions, approved seed schools and/or workshops.
- I. That said Employer will support active participation in Society affairs by said Technologist, including committee assignments, obligations of elective office, and compliance with Continuing Education requirements as defined in the By-laws.
- J. This contract becomes null and void when the said Technologist becomes a Registered Member Inactive.

IN CONSIDERATION THEREOF, the Society authorizes the Privileged Use of the Name, Insignia, Seal, and Seal Number of the Society of Commercial Seed Technologists, Inc., and the title: Registered Seed Technologist (or acronym RST) and the Society promises to uphold and protect the prestige and professional status of the Technologist as long as the Technologist fulfills all requirements as set forth in the Constitution and By-laws to remain a Registered Member of said Society.

Signature _____ Date _____
Technologist

Signature _____ Date _____
Employer

Title of Employer _____

Signature _____ Date _____
Executive Director, Society of Commercial Seed Technologists, Inc.

Seal Number Issued _____

Sample CVT or CPT Contract

**FOR PRIVILEGED USE OF NAME AND TITLE
CERTIFIED VIABILITY OR PURITY TECHNOLOGISTS (or acronym CVT OR CPT)
OF
THE SOCIETY OF COMMERCIAL SEED TECHNOLOGISTS, INC.**

This Contract is made by and between the Society of Commercial Seed Technologists, Inc.

(hereinafter Society), _____ Employee Certified Technologist

(hereinafter Technologist), and _____ (hereinafter Employer).

RECITALS

WHEREAS, Technologist wishes to have Privileged Use of the Name and Insignia of the Society of Commercial Seed Technologists, Inc., and the title: Certified Viability or Purity Technologists (or acronym CVT or CPT) of the Society; and

WHEREAS, Employer wishes to have the Society issue such Privileged Use of Name and Insignia of the Society of Commercial Seed Technologists, Inc., and the title: Registered Seed Technologist (or acronym RST) to the Technologist, for benefit of both Technologist and Employer; and

WHEREAS, Technologist and Employer understand and agree with the importance of maintaining the integrity of said Name and Insignia of the Society of Commercial Seed Technologists, Inc., and the title: Certified Viability or Purity Technologists (or acronym CVT or CPT) of the Society, and agree to use every effort to maintain same; and

WHEREAS, Technologist and Employer agree that such integrity would be undermined if the Name, Insignia, Seal, and Seal Number of the Society of Commercial Seed Technologists, Inc., and the title: Certified Viability or Purity Technologists (or acronym CVT or CPT) of the Society were employed on analysis reports, correspondence, or publications containing false, misleading, inaccurate, incomplete, or plagiarized information. Both Technologist and Employer further agree that the Society would be damaged by such misuse of said Name and Insignia, and the title: Certified Viability or Purity Technologists (or acronym CVT or CPT).

NOW, THEREFORE, IT IS AGREED AS FOLLOWS

- A. That the Society shall issue Privileged Use of Name, Insignia, Seal, Seal Number, and the title: Certified Viability or Purity Technologists (or acronym CVT or CPT) for the following uses, pursuant to the following terms:
1. Report of Analysis
 - a. that said Name and Insignia of the Society of Commercial Seed Technologists, Inc., and the title: Certified Viability or Purity Technologists (or acronym CVT or CPT) will be used only in reporting results from seed analysis done by, or under the direct supervision of the Technologist;
 - b. that said Name and Insignia of the Society of Commercial Seed Technologists, Inc., and the title: Certified Viability or Purity Technologists

(or acronym CVT or CPT) are to be used to show association only with the Technologists;

- c. that said Name and Insignia of the Society of Commercial Seed Technologists, Inc., and the title: Certified Viability or Purity Technologists (or acronym CVT or CPT) will not be used on a Report of Analysis containing false, misleading, inaccurate, incomplete, or plagiarized information.

2. Correspondence

- a. that said Name and Insignia and title Certified Viability or Purity Technologists (or acronym CVT or CPT)) may be used in association with the signature of the Technologist on any appropriate business and/or professional correspondence which does not contain false, misleading, inaccurate, or plagiarized information;

3. Publications

- a. that said Name and Insignia and title Certified Viability or Purity Technologists (or acronym CVT or CPT) may be used by Technologist and Employer in publications to promote the professionalism of their business or laboratory, if said publications do not contain false, misleading, inaccurate, or plagiarized information;

B. That the Privileged Use of said Name and Insignia Society of Commercial Seed Technologists, Inc., and the title: Certified Viability or Purity Technologists (or acronym CVT or CPT) will be canceled in the event of the death or change of employment of the Technologist, or the Technologist becoming a Certified Member Inactive.

C. That the said Name and Insignia of the Society of Commercial Seed Technologists, Inc., and the title: Certified Viability or Purity Technologists (or acronym CVT or CPT) shall remain the property of said Society.

D. That Technologist and Employer will comply with all terms of this contract concerning the proper use of said Name and Insignia of the Society of Commercial Seed Technologists, Inc., and the title: Certified Viability or Purity Technologists (or acronym CVT or CPT) of the Society, and furthermore will comply with any additional requirements as are currently now in effect, or as hereafter may be reasonably adopted in furtherance of the purposes of the Society in the Constitution, By-laws, or Executive Board Policy of said Society.

E. That in the event a Grievance Committee is appointed to investigate misuse of said Name and Insignia of the Society of Commercial Seed Technologists, Inc., and the title: Certified Viability or Purity Technologists (or acronym CVT or CPT) of the Society, all records bearing on such case will be made available, and to this end the Technologist and Employer will cooperate and abide by whatever actions deemed appropriate according to the Constitution and By-laws of said Society.

FURTHERMORE:

- F. That said Technologist will actively participate in Society affairs including committee assignments, obligations of elective office, and will comply with Continuing Education requirements as defined in the By-laws i.e., attendance at annual conventions, approved seed schools and/or workshops.

- G. That said Employer will support active participation in Society affairs by said Technologist, including committee assignments, obligations of elective office, and compliance with Continuing Education requirements as defined in the By-laws.

- H. This contract becomes null and void when the said Technologist becomes a Registered Member Inactive.

IN CONSIDERATION THEREOF, the Society authorizes the Privileged Use of the Name and Insignia, of the Society of Commercial Seed Technologists, Inc., and the title: Certified Viability or Purity Technologist (or acronym CVT or CPT) and the Society promises to uphold and protect the prestige and professional status of the Technologist as long as the Technologist fulfills all requirements as set forth in the Constitution and By-laws to remain a Certified Member of said Society.

Signature _____ Date _____
Technologist

Signature _____ Date _____
Employer

Title of Employer _____

Signature _____ Date _____
Executive Director, Society of Commercial Seed Technologists, Inc.

APPENDIX F. Minimum Prescribed Equipment and Current Reference Material

Check items listed below which you have in your laboratory.

****Exceptions are made for specific laboratory testing needs****

EQUIPMENT

- Analytical Balance
- Forceps
- Dissecting/Stereo Microscope
- Germination Media/Equipment
- Lighted Stand or Boom Magnification
- Mechanical Divider
- Purity Board
- Record/Reporting Forms

REFERENCE MATERIAL – Access to current editions required

- AOSA Rules for Testing Seeds, Volumes 1-4 (updated annually)
- Federal Seed Act (access to current edition)
- All State Noxious Weed List, USDA
- State Seed Law and Regulations
- Reference Seed Herbarium/Collection (minimum 150 kinds)

****SPECIALIZED EQUIPMENT****

- Fluorescence Equipment
- General Blower
- Prechill Chamber
- Purity Inspection Station
- Electronic Record Databases
- Diaphanoscope

EQUIPMENT AND REFERENCE MATERIAL SUGGESTED BY THE EXECUTIVE BOARD

EQUIPMENT

- Exhaust System
- NIST Thermometer
- Compressed Air
- Vacuum Planting System
- Water Deionizer
- Hand Lens (minimum 7X)

REFERENCE MATERIAL (current editions required)

- MSDS Information for chemicals encountered in laboratory and site
- RST Study Guide (available from SCST website)
- Seed Technologist Training Manual
- International Rules for Seed Testing
- Canadian Methods and Procedures for Testing Seed
- Canadian Seeds Act and Regulations
- Principles and Practices of Seed Science Technology (Copeland & McDonald)
- Identification of Crop and Weed Seeds, USDA Handbook 219
- Testing Agriculture and Vegetable Seeds, USDA Handbook 30
- AOSA Tetrazolium Handbook
- AOSA Vigor Testing Handbook
- AOSA Cultivar Purity Handbook
- Seed Testing Principles and Practices (Elias & Copeland)

APPENDIX G. EXAMPLES FOR MSU AND PSU

CSA-Purity, RST, CPT Exam Example
Page 1 of 2

Purity Practical

You are conducting a purity analysis on a sample of red fescue. The state into which the seed will be shipped does not consider any of the contaminating species given below as noxious.

- a. You are to classify the following 15 items. Based on the information provided below from Volume 3, Uniform Classification of Weed and Crop Seeds and your knowledge of AOSA Rules Volume 1 related to purity analyses, you are to classify each item as **one** of the following: pure seed (P), inert matter (I), other crop seed (C), or weed seed (W). *Circle your answer.*

NOMEN #	SCIENTIFIC NAME	COMMON NAME	FAMILY	SPP. CLASS	CONTAMINATING CLASSIFICATION							
					A	F	H	R	S	T	V	
2017	<i>Agrostis capillaris</i> L.	bentgrass, colonial	Poaceae	T	C	C	C	C	C	C	C	C
316592	<i>Brassica rapa</i> L. var. <i>rapa</i>	rape, annual turnip; rape, biennial turnip; rape, bird; turnip	Brassicaceae	A, V	C	W	W	W	W	W	W	C
7320	<i>Bromus hordeaceus</i> L.	brome, blando chess, soft	Poaceae	R	W	W	W	C	W	W	W	W
300215	<i>Festuca rubra</i> L. subsp. <i>rubra</i>	fescue, creeping red; fescue, red	Poaceae	T	C	C	C	C	C	C	C	C
22494	<i>Lolium perenne</i> L.	ryegrass, perennial	Poaceae	A, T	C	C	C	C	C	C	C	C
23613	<i>Medicago lupulina</i> L.	medic, black	Fabaceae	A	C	W	W	C	W	C	C	C
28920	<i>Poa bulbosa</i> L.	bluegrass, bulbous	Poaceae	A	W	W	W	W	W	W	W	W
28996	<i>Poa pratensis</i> L.	bluegrass, Kentucky	Poaceae	T	C	C	C	C	C	C	C	C
40219	<i>Trifolium dubium</i> Sibth.	clover, small hop; clover, suckling; shamrock, Irish	Fabaceae	A, F	W	C	W	W	W	W	W	W



1. P I C W



2. P I C W



3. P I C W



4. P I C W



5. P I C W



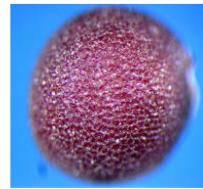
6. P I C W



7. P I C W



8. P I C W



9. P I C W



10. P I C W

APPENDIX G. EXAMPLES FOR MSU AND PSU

Viewed over a diaphanoscope.



11. P I C W 12. P I C W 13. P I C W 14. P I C W 15. P I C W

b. The following five items were taken from the pure seed portion of the working sample and each contains a caryopsis. Classify each item as either a single seed unit (S) or a multiple seed unit (M). Circle your answer. (5 points – 1 point per item)



16 17 18 19 20

16. S M
17. S M
18. S M
19. S M
20. S M

c. You have completed your purity separation and the component weights are given below. Based on the information provided, calculate the percentages of pure seed, other crop seeds, inert matter and weed seeds. Please show your work. (5 points)

	Percent of single units of each species	Red & Creeping red fescue	
Excerpt from Table 3B, Volume 1, Factor to apply to multiple units	50 or below	0.80	Data from purity separation Red fescue single florets 2.455 g Red fescue multiple florets 0.490 g Other crop seed 0.020 g Inert matter 0.059 g Weed seed 0.025 g TOTAL 3.049 g
	50.01-55.00	0.81	
	55.01-60.00	0.82	
	60.01-65.00	0.83	
	65.01-70.00	0.84	
	70.01-75.00	0.86	
	75.01-80.00	0.87	
	80.01-85.00	0.88	
	85.01-90.00	0.89	
	90.01-100.00	0.90	

Purity Practical

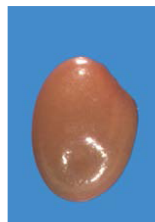
You are conducting a purity analysis on a sample of red fescue. The state into which the seed will be shipped does not consider any of the contaminating species given below as noxious.

a. You are to classify the following 15 items. Based on the information provided below from Volume 3, Uniform Classification of Weed and Crop Seeds and your knowledge of AOSA Rules Volume 1 related to purity analyses, you are to classify each item as one of the following: pure seed (P), inert matter (I), other crop seed (C), or weed seed (W). Circle your answer.

NOMEN #	SCIENTIFIC NAME	COMMON NAME	FAMILY	SPP. CLASS	CONTAMINATING CLASSIFICATION							
					A	F	H	R	S	T	V	
2017	<i>Agrostis capillaris</i> L.	bentgrass, colonial	Poaceae	T	C	C	C	C	C	C	C	C
316592	<i>Brassica rapa</i> L. var. <i>rapa</i>	rape, annual turnip; rape, biennial turnip; rape, bird; turnip	Brassicaceae	A, V	C	W	W	W	W	W	W	C
7320	<i>Bromus hordeaceus</i> L.	brome, blando chess, soft	Poaceae	R	W	W	W	C	W	W	W	W
300215	<i>Festuca rubra</i> L. subsp. <i>rubra</i>	fescue, creeping red; fescue, red	Poaceae	T	C	C	C	C	C	C	C	C
22494	<i>Lolium perenne</i> L.	ryegrass, perennial	Poaceae	A, T	C	C	C	C	C	C	C	C
23613	<i>Medicago lupulina</i> L.	medic, black	Fabaceae	A	C	W	W	C	W	C	C	C
28920	<i>Poa bulbosa</i> L.	bluegrass, bulbous	Poaceae	A	W	W	W	W	W	W	W	W
28996	<i>Poa pratensis</i> L.	bluegrass, Kentucky	Poaceae	T	C	C	C	C	C	C	C	C
40219	<i>Trifolium dubium</i> Sibth.	clover, small hop; clover, suckling; shamrock, Irish	Fabaceae	A, F	W	C	W	W	W	W	W	W



1. P I C W



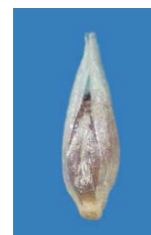
2. P I C W



3. P I C W



4. P I C W



5. P I C W



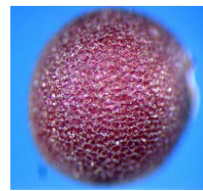
6. P I C W



7. P I C W



8. P L C W



9. P I C W



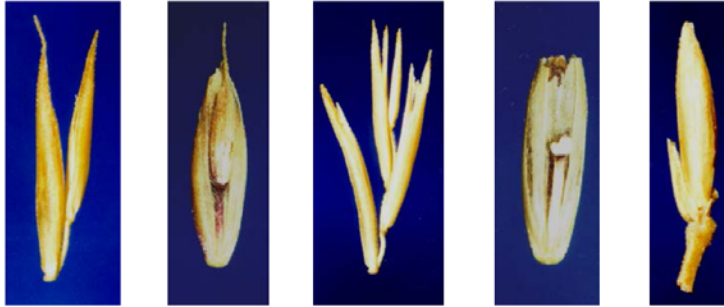
10. P I C W

Viewed over a diaphanoscope.



11. P I C W 12. P I C W 13. P I C W 14. P I C W 15. P I C W

b. The following five items were taken from the pure seed portion of the working sample and each contains a caryopsis. Classify each item as either a single seed unit (S) or a multiple seed unit (M). Circle your answer. (5 points – 1 point per item)



- 16 17 18 19 20

16. S M
17. S M
18. S M
19. S M
20. S M

c. You have completed your purity separation and the component weights are given below. Based on the information provided, calculate the percentages of pure seed, other crop seeds, inert matter and weed seeds. Please show your work. (5 points)

Percent of single units of each species	Red & Creeping red fescue
50 or below	0.80
50.01-55.00	0.81
55.01-60.00	0.82
60.01-65.00	0.83
65.01-70.00	0.84
70.01-75.00	0.86
75.01-80.00	0.87
80.01-85.00	0.88
85.01-90.00	0.89
90.01-100.00	0.90

Excerpt from Table 3B, Volume 1, Factor to apply to multiple units

Data from purity separation	
Red fescue single florets	2.455 g
Red fescue multiple florets	0.490 g
Other crop seed	0.020 g
Inert matter	0.059 g
Weed seed	0.025 g
TOTAL	3.049

$2.455 + 0.490 = 2.945$
$2.455 / 2.945 \times 100 = 83.36$
Factor = 0.88
$0.490 \times 0.88 = 0.431$
$0.490 - 0.431 = 0.059$
$2.455 + 0.431 = 2.886$
$0.059 + 0.059 = 0.118$

Pure seed	2.886	94.65%
Other crop	0.020	.66%
Inert Matter	0.118	3.87%
Weed Seed	0.025	.82%
Total	3.049	