

Society of Commercial Seed Technologists

RST/CVT/CPT Study Guide

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**SOCIETY COMMERCIAL SEED TECHNOLOGISTS
RST/CVT/CPT STUDY FORMAT**

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Introduction

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.”

The Society of Commercial Seed Technologists is a seed testing organization comprised of commercial, independent and government seed technologists. Formed in 1922, the SCST functioned 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.

MEMBERSHIP categories

There are eight membership categories in the SCST. Five of the membership categories (RST, RGT, CGT, CVT, 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 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 exam includes written purity and germination exams as well as a germination practical exam, seed separations, and seed identification. 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 Societies 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 on committees.

REGISTERED GENETIC TECHNOLOGIST (RGT)

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

An RGT has passed three of the four genetic technology exams: herbicide bioassay, electrophoresis, immunoassay testing (ELISA), and PCR. The RGT exam includes a required written molecular genetics and area specific written and practical exams in the four genetic technology areas. Detailed information on exam content is available in the RGT/CGT Study Guide.

RGTs 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 Societies name, logo, RGT seal, and the title Registered Genetics Technologist.

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

CERTIFIED GENETIC TECHNOLOGIST

These are individuals who have successfully qualified for and passed the CGT exam. The current qualifications include a minimum of one year of work experience, and accumulation of 100 points from workshops, college courses, and work experience.

An CGT has passed one or two of the four genetic technology exams: herbicide bioassay, electrophoresis, immunoassay testing (ELISA), and PCR. The CGT exam includes a required written molecular genetics and area specific written and practical exams in the four genetic technology areas. Detailed information on exam content is available in the RGT/CGT Study Guide.

CGTs 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 Genetic Technologist.

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

CERTIFIED VIABILITY OR PURITY TECHNOLOGIST

These are 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 written purity and germination exams as well as a germination practical exam. The CPT exam includes the written purity exam, and seed separations, and seed identification practical exams. 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 on any committees.

RESEARCH MEMBER

Research member are 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. They must also confirm that they have been active 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.

ASSOCIATE MEMBER

Associate Members are individuals with an interest in seed technology or pursuing an accreditation. They may chair or serve on committees and participate in all Society activities.

REQUIREMENTS FOR MEMBERSHIP

(RST/CVT/CPT)

1. Complete and return the membership application by March 1st (annually). Applications are available on the SCST website, www.seedtechnology.net, or by contacting the SCST executive director.
2. Fulfill the qualifications for the exam 14 days prior to the examination. The examination is given each year during Society of Commercial Seed Technologist (SCST) annual conference. Please visit the SCST website, www.seedtechnology.net, or by contacting the SCST executive director for upcoming exam dates and locations.
3. Obtain unanimous approval of the RST Board of Examiners (BOE). If a unanimous vote of said Board cannot be obtained, the Executive Board will act as a Board of Review.
4. RST and CPT candidates will submit to board of Examiners at time of examination a seed collection with a minimum 150 kinds.
5. Attain a passing grade in the prescribed examinations.

TRAINING

In order to prepare for the exam you will need to find a qualified tutor. Qualified tutors 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 tutor is usually your present supervisor or coworker or another analyst outside of your laboratory who agrees to assist you in your studies. It will be the supervisor or trainers responsibility to use their experience to assist in your training. The Supervisor or Tutor 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 a Registered or Certified member of the Society of Commercial Seed Technologists.

TUTORIAL PROGRAM

This is a distance training program for analysts who do not have a qualified tutor or adequate resources at their laboratory location. The SCST executive can help you find a tutor but the details of the arrangement will 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.

POINTS REQUIRED TO QUALIFY FOR THE EXAM

In order to take the RST, CVT, or CPT exam 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.

Example of courses that will be accepted:

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

- B. Approved seed schools and workshops-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. (Prior to taking the examination). Approved seed schools are those that are directly related to

seed technology and have been assigned continuing education points.

1. Full day hands on (minimum 5 ½ hrs.) = 2 points
2. Half day hands on (minimum 3 hrs.) = 1 point
3. Full day lecture (minimum 5 ½ hrs.) = 1 point
4. Half day lecture (minimum 3 hours) = .5 points

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

- E. Training under the supervision of a qualified tutor in purity analysis and germination. 1 point for each 80 hours training.
- F. Unsupervised testing experience in purity and germination. 1 point for each 160 hours experience.
- G. Combination of E and F which together meet the requirement of a minimum of 2 years experience in hands-on seed testing.
- H. If hands-on seed testing experience was obtained earlier than the immediate two years prior to submitting application for 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 examinations.

APPLICATIONS FOR MEMBERSHIP

Membership applications can be downloaded from the SCST website or are available from the Executive Director. Please check the SCST website or contact the Executive Director to ensure that you are submitting a current version of the membership application. It is recommended that you submit a trial application to the Executive Director before the March 1st deadline to ensure that you have fulfilled the requirements for membership. Please contact the Executive Director if you have any questions or need help completing the application for membership.

THE EXAMINATIONS

Exam candidates should think of taking the RST, CVT or CPT examinations as the beginning step of training in seed analysis and not the conclusion. The examinations are given once a year preceding the AOSA-SCST Annual Conference. Eight hours are allotted to complete all sections of the exam.

Candidates who wish to become Registered Seed Technologists will take all five exam sections: purity written, purity practical, seed identification, germination written and germination practical. Candidates who wish to become Certified will take the sections of the exam as outlined below.

The Viability exam consists of three sections: written purity, written germination and practical germination. The following is a break down of exam content:

Germination Written Exam (100 points)

- 70% Germination, dormancy, viability questions
- 15% Tetrazolium questions
- 15% Vigor questions

Purity Written Examination (100 points)

- 85% Purity questions: classification, purity component calculations, multiple floret determinations, AOSA Rules, Handbook 25 & uniform blower usage.
- 15% Quality Assurance questions

Germination Practical Examination (100 points)

- 90% Seedling classification
- 10% Tetrazolium staining

The Purity examination consists of three sections: written practical, purity practical and the seed identification. The following is a break down of exam content:

Purity Written Examination (100 points)

- 85% Purity questions: classification, purity component calculations, multiple floret determinations, AOSA Rules, Handbook 25 & uniform blower usage.
- 15% Quality Assurance questions

Purity Practical Examination (100 points)

- 75% seed separation
- 20% object classification
- 5% divider usage

Seed Identification Test (100 points)

- 100% seed ID – 50 species @ 2 points each

PASSING GRADES

An applicant shall fulfill the following qualifications:

1. Have a grade of 70% or better on each part of the examination.
2. Have an average grade of 80% or better for the entire examination

Time limits:

1. Approximately one and a half hours is allotted for each part of the exam.

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.htm. 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 by going to the link 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. Official 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. Official 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. AOSA (www.aosaseed.com)

Uniform Classification of Weed and Crop Seeds. AOSA #25
Seedling Evaluation Handbook. AOSA #35
Seed Vigor Testing Methods Handbook. AOSA
Tetrazolium Testing Handbook AOSA
Cultivar Purity Handbook. AOSA
Rules & Regulations under Federal Seed Act. 1975 USDA, Wash. DC
(available from http://www.ams.usda.gov/lsg/seed/seed_pub.htm)
Seed Act Regulations of Canada. Agriculture Canada, Ottawa
(<http://www.inspection.gc.ca/english/plaveg/seesem/seeseme.shtml#actloi>)
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. AOSA (www.aosaseed.com)
Uniform Classification of Weed and Crop Seeds. AOSA #25
Cultivar Purity Handbook. AOSA
Rules & Regulations under Federal Seed Act. 1975 USDA, Wash. DC
(available from http://www.ams.usda.gov/lsg/seed/seed_pub.htm)
Seed Act Regulations of Canada. Agriculture Canada, Ottawa
(<http://www.inspection.gc.ca/english/plaveg/seesem/seeseme.shtml#actloi>)
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. Handbook #219 USDA, Washington, DC
Testing Agriculture and Vegetable Seeds. USDA 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:

- A. Classification of plants (Taxonomy)
- B. Structure of seed plants

- C. Vegetative parts of a seed plant:
 - 1. Roots
 - 2. Stems
 - 3. Leaves
- D. Reproductive parts of a seed plant:
 - 1. Flower
 - 2. Fruit
- E. Study cell development
- F. Follow with Dr. Copeland & Dr. McDonald's book, "Principles of Seed Science and Technology" (4th Edition, 2001), Chapters 1, 2, and 3

Know the 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 (email: aosaoffice@earthlink.net, phone: 505-522-1437). Complete knowledge of the Rules for Testing Seeds is of prime importance.

PURITY

Study especially:

1. Procedure of sampling.
2. Procedure of 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 percent 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 number of seeds needed for germination.
4. Learn evaluation of seedlings by family. You will notice seedlings of the same family will usually have 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)

RST/CPT Only

- A. Each candidate for the Registered Seed Technologist and Certified Purity examination are required to make a seed collection.
- B. Any workable type of container may be used such as vials or small plastic packets.
- C. Each kind should be labeled with the following information:
 - Genus, species, common name
 - Family
 - Origin/Source of seed
 - Date of collection or addition to collection
 - Category such as crop, weed, and if noxious (this may change over time)
- D. In making collection, preference should be given to:
 - 1. Crop and vegetable seeds in general usage.
 - 2. Noxious weed seeds occurring most frequently on the All-States and Canadian noxious weed seed list.
(http://www.ams.usda.gov/lsg/seed/seed_pub.htm)
 - 3. Kinds of seeds and crops easily confused.
 - 4. Common weeds.
- E. This collection should be of practical value in preparing for the identification portion of the examination.
- F. The collection is to be presented at the time of the examination and will be returned.

IDENTIFICATION OF SEEDS

RST/CPT Only

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. You can also use the Lending Library from Mid-West Seed Services (<http://mwseed.com>). 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 on one side and Latin name, and a few specific characteristics on the opposite. 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/java/imageGallery>)

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, tree/shrub, and weed seeds.

While you are learning identification try to remember the Botanical 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 Handbook 25 for proper classification of seed.

See Appendix for Seed Identification list, Glossary of Terms, Appendix B for Acronyms and Definitions.

SPECIAL STUDIES

Viability

1. Seed Vigor Testing Handbook (Contribution No. 32)
Part I Seed Vigor - Its Meaning and Application
 - a. Evolution of Concept
 - b. Methods of Measuring Seed Vigor
 - c. Standardization of Seed Vigor Test Procedures
 - d. Application of Vigor Test Results
2. Other Vigor References
 - a. A.O.S.A. Newsletter Vol. 51, No. 5. 11-77 pp. 14-21 and 42-51
 - b. Journal of Seed Technology Vol. 1, 1976, No. 2 Seed Vigor and Deterioration
3. Uniform Blowing Procedure
A.O.S.A. Rules for Testing Seed

4. Fluorescence Test for Ryegrass
A.O.S.A. Rules for Testing Seed
5. Tetrazolium Testing Handbook (Contribution No. 29, 2000 edition. 2001 updates are available from the AOSA website)
 - a. Study general procedures
 - b. Value of Tetrazolium Testing
6. Cultivar Purity Testing Handbook (Contribution No. 33)
 - 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
A.O.S.A. Rules for Testing Seed

FEDERAL SEED ACT

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

Study the regulations on:

1. Interstate shipping
2. Importations
3. Certification

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 OF TESTING SEEDS

Review the difference between labeling in Canada and in the United States. Know some of the Canadian Noxious Prohibited Weeds. Familiarize yourself with the difference between AOSA procedures and the Canadian Rules of Testing Seeds. Be able to explain the use of Canadian Grade Tables. The Methods & Procedures can be found at:

<http://www.inspection.gc.ca/english/plaveg/seesem/seeseme.shtml>

ISTA RULES

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. T.Z. Handbook
3. Areas covered by the ISTA Rules
 - Sampling
 - Purity
 - Germination
 - Cultivar
 - Vigor
 - Moisture
 - Seed Health Testing
4. Use of Orange Seed Lot and Blue Sample Certificates
5. Accredited laboratories
 - Proficiency testing
 - 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 and the USDA Reserve Seed Collection:

<http://www.ams.usda.gov/lsg/seed/reserve.htm>

- Study basic botany
- Begin reading the Rules 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
- Read the Cultivar Purity Handbook
- Read the Vigor Handbook
- Read the Moisture Testing Handbook
- Understand Handbook 25 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 5 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 in depth each chapter of the rules. 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 you are unfamiliar with. If you need help finding someone to call the SCST 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:
 1. 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.
 2. Written germination written quizzes should include:
 - Basic botany- id flower and seed parts
 - Key family characteristics in seedling evaluation (is a primary root required?)
 - 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?
 3. Practical purity quizzes should include seed identification, separations, and pure seed unit classification.
 4. 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_committee.htm

- Daily seed identification and separation quizzes are useful.
- Continue weekly seedling evaluation quizzes
- Practice writing out 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 library: http://www.seedtechnology.net/seed_library.htm

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 everyday 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 lots of people that are willing to help you succeed.

WHAT IS THIS 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, 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

Just 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 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?

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.

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?

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?

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

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

If it's a weed, inert.

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

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:

***Define** Uniform Blowing Procedure. OR
What is the **Definition** of the Uniform Blowing Procedure?*

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

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.

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. Examples are below with varied question format, with both answers being correct for each question.

*What is the **Procedure** for Uniform Blowing?
Describe the step-by-step **Process** for the Uniform Blowing Procedure.
Give the step by-step **Procedure** for Uniform Blowing.*

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:

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

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.

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

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

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 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.

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:

Compare germination and vigor as it relates to seed testing.

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

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:

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

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 inert.

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, 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.

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

Uniform Blowing Procedure:

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

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 inert.

Kentucky bluegrass, rough bluegrass, and Canada bluegrass

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

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.

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?

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. Take a look in the RST Study Guide 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, many offer hands-on training in purity, germination, vigor and Tetrazolium testing. The following organizations hold regular seed schools:

Oregon State University: <http://www.css.orst.edu/seedlab>

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

Mid-West Seed Services: www.mwseed.com.

Colorado State University - Fort Collins: www.learn.colostate.edu

Federal Seed Schools: Locations and dates vary.

Other labs may offer regional workshops. Please check the SCST website, www.seedtechnology.net, for current listings of upcoming workshops.

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 Privileged 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 \$250. Members may be suspended for delinquency of more than six months in payment of dues.

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 ($\frac{1}{2}$) 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. Laboratory Inspection forms are available for download from the SCST website or by contacting the Executive Director.

REGISTERED OR CERTIFIED 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) can not 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.

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 (5 points for each year inactive up to a maximum of 25 points), payment of all unpaid dues and assessments during any fiscal year and approval by the Executive Director.

REEXAMINATION

The following continuing education requirements must be met before an applicant can qualify for reexamination:

10 points at time of reapplication within one year after original examination.

20 points at time of reapplication if greater than one year, a maximum of 25 points is required for reapplication.

Obtained by:

Workshops, seed workshops or individualized training outside of the analyst's regular work environment.

Procedures for obtaining points for continuing education through seed workshops or individualized training outside of the analyst's regular work environment are as follows:

Tutor/trainer provides agenda for the training to the Executive Director prior to training.

Agenda must include:

- Name and address of seed school, seed workshop or individual tutor/trainer.
- Dates and times of proposed training
- Content of training

The amount of points allowed will be:

- Full day (minimum 5 1/2 hrs.) = 2 points
- Half day (minimum 3 hrs.) = 1 point

College courses must meet the criteria listed in the Study Guide. If a course is not listed please provide a copy of the course syllabus to the Executive Director to review for approval before registering for the course.

APPENDIX A. SEED IDENTIFICATION LIST

SEED IDENTIFICATION LIST Revised 4/2007

| Family | Genus | Specific epithet | subsp. or var. | common names |
|---------------|----------------------|-----------------------|-----------------------------------|-----------------------------------------------------------|
| Aceraceae | <i>Acer</i> | <i>rubrum</i> | | red maple |
| Aizoaceae | <i>Tetragonia</i> | <i>tetragonioides</i> | | New Zealand spinach |
| Amaranthaceae | <i>Amaranthus</i> | <i>albus</i> | | tumble pigweed |
| Apiaceae | <i>Anethum</i> | <i>graveolens</i> | | dill |
| Apiaceae | <i>Apium</i> | <i>graveolens</i> | | celery |
| Apiaceae | <i>Carum</i> | <i>carvi</i> | | caraway |
| Apiaceae | <i>Chaerophyllum</i> | <i>procumbens</i> | | spreading chervil |
| Apiaceae | <i>Conium</i> | <i>maculatum</i> | | poison hemlock |
| Apiaceae | <i>Coriandrum</i> | <i>sativum</i> | | coriander |
| Apiaceae | <i>Daucus</i> | <i>carota</i> | subsp. <i>sativa</i> | carrot |
| Apiaceae | <i>Pastinaca</i> | <i>sativa</i> | | parsnip |
| Apiaceae | <i>Petroselinum</i> | <i>crispum</i> | | parsley |
| Apiaceae | <i>Torilis</i> | <i>nodosa</i> | | knotted hedge-parsley |
| Asteraceae | <i>Achillea</i> | <i>millefolium</i> | | common yarrow, woolly yarrow |
| Asteraceae | <i>Acroptilon</i> | <i>repens</i> | | Russian knapweed |
| Asteraceae | <i>Ambrosia</i> | <i>trifida</i> | | gian ragweed |
| Asteraceae | <i>Anthemis</i> | <i>arvensis</i> | | field chamomile |
| Asteraceae | <i>Anthemis</i> | <i>cotula</i> | | dogfennel, mayweed |
| Asteraceae | <i>Arctium</i> | <i>lappa</i> | | great burdock |
| Asteraceae | <i>Carduus</i> | <i>acanthoides</i> | | plumeless thistle |
| Asteraceae | <i>Carduus</i> | <i>nutans</i> | | musk thistle, nodding thistle |
| Asteraceae | <i>Carthamus</i> | <i>tinctorius</i> | | safflower |
| Asteraceae | <i>Centaurea</i> | <i>cyanus</i> | | cornflower, bachelor's button, ragged robin |
| Asteraceae | <i>Centaurea</i> | <i>solstitialis</i> | | yellow starthistle |
| Asteraceae | <i>Cichorium</i> | <i>endivia</i> | | endive |
| Asteraceae | <i>Cirsium</i> | <i>arvense</i> | | Canada thistle |
| Asteraceae | <i>Cirsium</i> | <i>undulatum</i> | | wavyleaf thistle |
| Asteraceae | <i>Cirsium</i> | <i>vulgare</i> | | bull thistle |
| Asteraceae | <i>Cnicus</i> | <i>benedictus</i> | | blessed thistle |
| Asteraceae | <i>Crepis</i> | <i>capillaris</i> | | smooth hawksbeard |
| Asteraceae | <i>Cynara</i> | <i>cardunculus</i> | | artichoke, cardoon, artichoke thistle |
| Asteraceae | <i>Helianthus</i> | <i>annuus</i> | all types, cultivated and wild | common sunflower, wild sunflower |
| Asteraceae | <i>Helianthus</i> | <i>ciliaris</i> | | blueweed |
| Asteraceae | <i>Hypochaeris</i> | <i>radicata</i> | | spotted cat's-ear |
| Asteraceae | <i>Iva</i> | <i>axillaris</i> | | poverty weed, poverty sumpweed, mouse-ear poverty weed |
| Asteraceae | <i>Lactuca</i> | <i>sativa</i> | cultivated | lettuce |
| Asteraceae | <i>Leucanthemum</i> | <i>vulgare</i> | | oxeye daisy, Shasta daisy |
| Asteraceae | <i>Madia</i> | <i>sativa</i> | | Chilean tarweed |
| Asteraceae | <i>Onopordum</i> | <i>acanthium</i> | | Scotch thistle, cotton thistle |

| | | | | |
|-----------------|-------------------------|-----------------------|------------------------|-------------------------------------------------------------|
| Asteraceae | <i>Picris</i> | <i>echioides</i> | | bristly ox-tongue |
| Asteraceae | <i>Rudbeckia</i> | <i>hirta</i> | | black-eyed-Susan, hairy coneflower |
| Asteraceae | <i>Sonchus</i> | <i>arvensis</i> | | perennial sowthistle |
| Asteraceae | <i>Sonchus</i> | <i>oleraceus</i> | | annual sowthistle |
| Asteraceae | <i>Tagetes</i> | <i>patula</i> | | French marigold |
| Asteraceae | <i>Taraxacum</i> | <i>officinale</i> | | dandelion |
| Asteraceae | <i>Tragopogon</i> | <i>porrifolius</i> | | oysterplant, salsify |
| Asteraceae | <i>Tragopogon</i> | <i>pratensis</i> | | yellow goatsbeard, meadow salsify |
| Asteraceae | <i>Tripleurospermum</i> | <i>maritimum</i> | subsp. <i>inodorum</i> | scentless mayweed |
| Asteraceae | <i>Xanthium</i> | <i>strumarium</i> | | common cocklebur |
| Boraginaceae | <i>Amsinckia</i> | <i>tessellata</i> | | western fiddleneck |
| Boraginaceae | <i>Buglossoides</i> | <i>arvensis</i> | | corn gromwell, field gromwell |
| Boraginaceae | <i>Echium</i> | <i>vulgare</i> | | blueweed |
| Boraginaceae | <i>Lappula</i> | <i>squarrosa</i> | | bluebur, European stickseed |
| Brassicaceae | <i>Barbarea</i> | <i>verna</i> | | upland cress, early wintercress |
| Brassicaceae | <i>Barbarea</i> | <i>vulgaris</i> | | bitter wintercress, yellowrocket |
| Brassicaceae | <i>Berteroa</i> | <i>incana</i> | | hoary alyssum |
| Brassicaceae | <i>Brassica</i> | <i>juncea</i> | | brown mustard, India mustard, Indian mustard |
| Brassicaceae | <i>Brassica</i> | <i>napus</i> | var. <i>napus</i> | annual rape, winter rape |
| Brassicaceae | <i>Brassica</i> | <i>nigra</i> | | black mustard, wild mustard |
| Brassicaceae | <i>Brassica</i> | <i>oleracea</i> | var. <i>botrytis</i> | broccoli, cauliflower |
| Brassicaceae | <i>Brassica</i> | <i>rapa</i> | var. <i>rapa</i> | annual turnip rape, biennial turnip rape, bird rape, turnip |
| Brassicaceae | <i>Camelina</i> | <i>microcarpa</i> | | littleseed falseflax |
| Brassicaceae | <i>Camelina</i> | <i>sativa</i> | | bigseed falseflax |
| Brassicaceae | <i>Capsella</i> | <i>bursa-pastoris</i> | | shepherd's-purse |
| Brassicaceae | <i>Crambe</i> | <i>abyssinica</i> | | crambe |
| Brassicaceae | <i>Lepidium</i> | <i>draba</i> | subsp. <i>draba</i> | heart-podded hoarycress, whitetop |
| Brassicaceae | <i>Lepidium</i> | <i>latifolium</i> | | perennial peppercress, perennial pepperweed, tall whitetop |
| Brassicaceae | <i>Lepidium</i> | <i>sativum</i> | | garden cress |
| Brassicaceae | <i>Nasturtium</i> | <i>officinale</i> | | watercress |
| Brassicaceae | <i>Raphanus</i> | <i>raphanistrum</i> | | wild radish |
| Brassicaceae | <i>Raphanus</i> | <i>sativus</i> | | radish |
| Brassicaceae | <i>Rapistrum</i> | <i>rugosum</i> | | common giant mustard, turnipweed |
| Brassicaceae | <i>Sinapis</i> | <i>alba</i> | | white mustard |
| Brassicaceae | <i>Sinapis</i> | <i>arvensis</i> | | charlock, field mustard, wild mustard, wild turnip |
| Brassicaceae | <i>Thlaspi</i> | <i>arvense</i> | | fanweed, Frenchweed, field pennycress |
| Caryophyllaceae | <i>Agrostemma</i> | <i>githago</i> | | corncockle |
| Caryophyllaceae | <i>Dianthus</i> | <i>barbatus</i> | | sweet William |
| Caryophyllaceae | <i>Silene</i> | <i>latifolia</i> | subsp. <i>alba</i> | white campion, white cockle |
| Caryophyllaceae | <i>Silene</i> | <i>noctiflora</i> | | night-flowering catchfly |
| Caryophyllaceae | <i>Silene</i> | <i>vulgaris</i> | subsp. <i>vulgaris</i> | bladder campion, cowbell campion |
| Caryophyllaceae | <i>Stellaria</i> | <i>media</i> | | common chickweed |
| Caryophyllaceae | <i>Vaccaria</i> | <i>hispanica</i> | | cow-cockle |
| Chenopodiaceae | <i>Atriplex</i> | <i>canescens</i> | | fourwing saltbush |

| | | | | |
|----------------|---------------------|----------------------|------------------------|---------------------------------------------------------------------------------------|
| Chenopodiaceae | <i>Bassia</i> | <i>scoparia</i> | | kochia |
| Chenopodiaceae | <i>Beta</i> | <i>vulgaris</i> | subsp. <i>vulgaris</i> | beet, field beet, sugar beet, Swiss chard |
| Chenopodiaceae | <i>Chenopodium</i> | <i>album</i> | | common lamb's-quarters |
| Chenopodiaceae | <i>Chenopodium</i> | <i>quinoa</i> | | five-lobed goosefoot, quinoa |
| Chenopodiaceae | <i>Salsola</i> | <i>tragus</i> | | common Russian-thistle, tumbling Russian-thistle |
| Chenopodiaceae | <i>Spinacia</i> | <i>oleracea</i> | | spinach |
| Clusiaceae | <i>Hypericum</i> | <i>perforatum</i> | | common St John's-wort, klamathweed |
| Convolvulaceae | <i>Calystegia</i> | <i>sepium</i> | | hedge bindweed |
| Convolvulaceae | <i>Convolvulus</i> | <i>arvensis</i> | | field bindweed |
| Convolvulaceae | <i>Cuscuta</i> | <i>pentagona</i> | | field dodder |
| Convolvulaceae | <i>Dichondra</i> | <i>repens</i> | | dichondra |
| Convolvulaceae | <i>Ipomoea</i> | <i>alba</i> | | moonflower, white morning-glory |
| Convolvulaceae | <i>Ipomoea</i> | <i>hederacea</i> | | ivyleaf morning-glory |
| Convolvulaceae | <i>Ipomoea</i> | <i>purpurea</i> | | tall morning-glory, wild morning-glory, woolly morning-glory |
| Cucurbitaceae | <i>Citrullus</i> | <i>lanatus</i> | var. <i>lanatus</i> | watermelon |
| Cucurbitaceae | <i>Cucumis</i> | <i>melo</i> | | muskmelon, cantaloupe, honeydew |
| Cucurbitaceae | <i>Cucumis</i> | <i>sativus</i> | | cucumber |
| Cucurbitaceae | <i>Cucurbita</i> | <i>maxima</i> | | mammoth pumpkin, winter large squash |
| Cucurbitaceae | <i>Cucurbita</i> | <i>pepo</i> | | small gourd, common pumpkin, acorn squash, summer squash |
| Cyperaceae | <i>Carex</i> | <i>stipata</i> | | owlfruit sedge |
| Cyperaceae | <i>Cyperus</i> | <i>esculentus</i> | | yellow nutgrass, yellow nutsedge |
| Cyperaceae | <i>Cyperus</i> | <i>rotundus</i> | | purple nutgrass, purple nutsedge |
| Cyperaceae | <i>Scirpus</i> | <i>pendulus</i> | | rufous bulrush |
| Euphorbiaceae | <i>Acalypha</i> | <i>virginica</i> | | three-seeded mercury |
| Euphorbiaceae | <i>Chamaesyce</i> | <i>maculata</i> | | spotted spurge |
| Euphorbiaceae | <i>Euphorbia</i> | <i>esula</i> | | leafy spurge |
| Euphorbiaceae | <i>Ricinus</i> | <i>communis</i> | | castorbean |
| Fabaceae | <i>Aeschynomene</i> | <i>indica</i> | | ding ding, curly indigo, Indian jointvetch, northern jointvetch, sensitive jointvetch |
| Fabaceae | <i>Arachis</i> | <i>hypogaea</i> | | peanut, |
| Fabaceae | <i>Cicer</i> | <i>orientinum</i> | | chickpea, garbanzo bean |
| Fabaceae | <i>Crotalaria</i> | <i>spectabilis</i> | | showy crotalaria, showy rattlepod |
| Fabaceae | <i>Cyamopsis</i> | <i>tetragonoloba</i> | | guar |
| Fabaceae | <i>Glycine</i> | <i>max</i> | | soybean |
| Fabaceae | <i>Kummerowia</i> | <i>stipulacea</i> | | Korean lespedeza |
| Fabaceae | <i>Kummerowia</i> | <i>striata</i> | | common lespedeza, striate lespedeza |
| Fabaceae | <i>Lathyrus</i> | <i>aphaca</i> | | yellow pea, yellow vetchling |
| Fabaceae | <i>Lathyrus</i> | <i>hirsutus</i> | | rough-pea |
| Fabaceae | <i>Lathyrus</i> | <i>sylvestris</i> | | flat-pea |
| Fabaceae | <i>Lens</i> | <i>culinaris</i> | | lentil |
| Fabaceae | <i>Lespedeza</i> | <i>cuneata</i> | | Chinese lespedeza, sericea lespedeza |
| Fabaceae | <i>Lotus</i> | <i>corniculatus</i> | | birdsfoot trefoil |
| Fabaceae | <i>Lotus</i> | <i>uliginosus</i> | | big trefoil |
| Fabaceae | <i>Medicago</i> | <i>lupulina</i> | | black medic |

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|-------------|----------------------|----------------------|---------------------------|----------------------------------------------------------|
| Fabaceae | <i>Medicago</i> | <i>sativa</i> | | alfalfa, lucerne |
| Fabaceae | <i>Melilotus</i> | <i>albus</i> | | white sweetclover, hubam sweetclover |
| Fabaceae | <i>Melilotus</i> | <i>indicus</i> | | sourclover |
| Fabaceae | <i>Melilotus</i> | <i>officinalis</i> | | yellow sweetclover |
| Fabaceae | <i>Phaseolus</i> | <i>coccineus</i> | | scarlet runner bean |
| Fabaceae | <i>Phaseolus</i> | <i>lunatus</i> | | lima bean |
| Fabaceae | <i>Phaseolus</i> | <i>vulgaris</i> | | field bean, garden bean |
| Fabaceae | <i>Pisum</i> | <i>sativum</i> | | field pea, garden pea |
| Fabaceae | <i>Securigera</i> | <i>varia</i> | | crownvetch |
| Fabaceae | <i>Sesbania</i> | <i>exaltata</i> | | tall indigo, peatree, Colorado river-hemp, hemp sesbania |
| Fabaceae | <i>Trifolium</i> | <i>campestre</i> | | large hop clover, low hop clover |
| Fabaceae | <i>Trifolium</i> | <i>dubium</i> | | small hop clover, suckling clover, Irish shamrock |
| Fabaceae | <i>Trifolium</i> | <i>fragiferum</i> | | strawberry clover |
| Fabaceae | <i>Trifolium</i> | <i>hirtum</i> | | rose clover |
| Fabaceae | <i>Trifolium</i> | <i>hybridum</i> | | alsike clover |
| Fabaceae | <i>Trifolium</i> | <i>incarnatum</i> | | crimson clover |
| Fabaceae | <i>Trifolium</i> | <i>pratense</i> | | red clover |
| Fabaceae | <i>Trifolium</i> | <i>repens</i> | | ladino clover, white clover |
| Fabaceae | <i>Trifolium</i> | <i>subterraneum</i> | | subterranean clover, subclover |
| Fabaceae | <i>Trifolium</i> | <i>vesiculosum</i> | | arrowleaf clover |
| Fabaceae | <i>Vicia</i> | <i>benghalensis</i> | | purple vetch |
| Fabaceae | <i>Vicia</i> | <i>faba</i> | | broadbean, fava-bean, horsebean |
| Fabaceae | <i>Vicia</i> | <i>grandiflora</i> | | showy vetch |
| Fabaceae | <i>Vicia</i> | <i>sativa</i> | subsp. <i>sativa</i> | common vetch |
| Fabaceae | <i>Vicia</i> | <i>villosa</i> | subsp. <i>villosa</i> | hairy vetch |
| Fabaceae | <i>Vigna</i> | <i>radiata</i> | var. <i>radiata</i> | mung bean |
| Fabaceae | <i>Vigna</i> | <i>unguiculata</i> | subsp. <i>unguiculata</i> | black-eyed pea, cowpea, southernpea |
| Geraniaceae | <i>Erodium</i> | <i>cicutarium</i> | | alfilaria, redstem filaree |
| Geraniaceae | <i>Geranium</i> | <i>dissectum</i> | | cutleaf geranium |
| Juncaceae | <i>Juncus</i> | <i>tenuis</i> | | path rush |
| Lamiaceae | <i>Dracocephalum</i> | <i>parviflorum</i> | | American dragonhead |
| Lamiaceae | <i>Mentha</i> | <i>xpiperita</i> | | peppermint |
| Lamiaceae | <i>Nepeta</i> | <i>cataria</i> | | catnip |
| Lamiaceae | <i>Ocimum</i> | <i>basilicum</i> | | sweet basil |
| Lamiaceae | <i>Prunella</i> | <i>vulgaris</i> | | heal-all, self-heal |
| Lamiaceae | <i>Salvia</i> | <i>officinalis</i> | | sage |
| Lamiaceae | <i>Teucrium</i> | <i>canadense</i> | | American germander, wood-sage |
| Lilliaceae | <i>Allium</i> | <i>canadense</i> | | wild onion, wild bulbous onion |
| Lilliaceae | <i>Allium</i> | <i>cepa</i> | | onion |
| Lilliaceae | <i>Allium</i> | <i>fistulosum</i> | | Welsh onion |
| Lilliaceae | <i>Allium</i> | <i>porrum</i> | | leek |
| Lilliaceae | <i>Allium</i> | <i>schoenoprasum</i> | | chives |
| Lilliaceae | <i>Allium</i> | <i>vineale</i> | | wild garlic |
| Lilliaceae | <i>Asparagus</i> | <i>officinalis</i> | | asparagus |

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|----------------|----------------------|----------------------|-----------------------|--------------------------------------|
| Linaceae | <i>Linum</i> | <i>usitatissimum</i> | | flax |
| Malvaceae | <i>Abelmoschus</i> | <i>esculentus</i> | | okra |
| Malvaceae | <i>Abutilon</i> | <i>theophrasti</i> | | butterprint, velvetleaf |
| Malvaceae | <i>Gossypium</i> | <i>hirsutum</i> | | upland cotton |
| Malvaceae | <i>Malva</i> | <i>parviflora</i> | | little mallow |
| Malvaceae | <i>Malvella</i> | <i>leprosa</i> | | alkali mallow, alkali sida |
| Malvaceae | <i>Sida</i> | <i>spinosa</i> | | prickly mallow, prickly sida |
| Onagraceae | <i>Gaura</i> | <i>sinuata</i> | | wavy leaved gaura |
| Onagraceae | <i>Oenothera</i> | <i>macrocarpa</i> | | Missouri primrose, Ozark sundrops |
| Oxalidaceae | <i>Oxalis</i> | <i>stricta</i> | | yellow woodsorrel |
| Papaveraceae | <i>Papaver</i> | <i>rhoeas</i> | | corn poppy |
| Pedaliaceae | <i>Sesamum</i> | <i>indicum</i> | | sesame |
| Pinaceae | <i>Abies</i> | <i>concolor</i> | | white fir |
| Pinaceae | <i>Pinus</i> | <i>ponderosa</i> | | ponderosa pine, western yellow pine |
| Plantaginaceae | <i>Plantago</i> | <i>aristata</i> | | bracted plantain |
| Plantaginaceae | <i>Plantago</i> | <i>lanceolata</i> | | buckhorn, buckhorn plantain |
| Plantaginaceae | <i>Plantago</i> | <i>major</i> | | broadleaf plantain, common plantain |
| Plantaginaceae | <i>Plantago</i> | <i>rugelii</i> | | blackseed plantain, Rugel's plantain |
| Plantaginaceae | <i>Plantago</i> | <i>virginica</i> | | paleseed plantain, Virginia plantain |
| Poaceae | <i>xTritosecale</i> | | | triticale |
| Poaceae | <i>Achnatherum</i> | <i>hymenoides</i> | | Indian ricegrass |
| Poaceae | <i>Aegilops</i> | <i>cylindrica</i> | | jointed goatgrass |
| Poaceae | <i>Agropyron</i> | <i>desertorum</i> | | standard crested wheatgrass |
| Poaceae | <i>Agrostis</i> | <i>capillaris</i> | | colonial bentgrass |
| Poaceae | <i>Agrostis</i> | <i>gigantea</i> | | redtop |
| Poaceae | <i>Agrostis</i> | <i>stolonifera</i> | var. <i>palustris</i> | creeping bentgrass |
| Poaceae | <i>Aira</i> | <i>caryophyllea</i> | | silver hairgrass |
| Poaceae | <i>Alopecurus</i> | <i>geniculatus</i> | | water foxtail |
| Poaceae | <i>Alopecurus</i> | <i>pratensis</i> | | meadow foxtail |
| Poaceae | <i>Andropogon</i> | <i>gerardii</i> | | big bluestem |
| Poaceae | <i>Andropogon</i> | <i>hallii</i> | | sand bluestem |
| Poaceae | <i>Anthoxanthum</i> | <i>odoratum</i> | | sweet vernalgrass |
| Poaceae | <i>Arrhenatherum</i> | <i>elatius</i> | | tall oatgrass |
| Poaceae | <i>Avena</i> | <i>fatua</i> | | wild oat |
| Poaceae | <i>Avena</i> | <i>sativa</i> | | oat |
| Poaceae | <i>Axonopus</i> | <i>fissifolius</i> | | carpetgrass |
| Poaceae | <i>Bothriochloa</i> | <i>ischaemum</i> | | yellow bluestem |
| Poaceae | <i>Bouteloua</i> | <i>curtipendula</i> | | side-oats grama |
| Poaceae | <i>Bouteloua</i> | <i>dactyloides</i> | | buffalograss |
| Poaceae | <i>Bouteloua</i> | <i>gracilis</i> | | blue grama |
| Poaceae | <i>Bromus</i> | <i>catharticus</i> | | prairie brome, rescuegrass |
| Poaceae | <i>Bromus</i> | <i>commutatus</i> | | hairy brome, hairy chess |
| Poaceae | <i>Bromus</i> | <i>diandrus</i> | var. <i>rigidus</i> | ripgut brome |
| Poaceae | <i>Bromus</i> | <i>hordeaceus</i> | | blando brome, soft chess |

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|---------|--------------------|---------------------|----------------------------|----------------------------------------------|
| Poaceae | <i>Bromus</i> | <i>inermis</i> | subsp. <i>inermis</i> | smooth brome |
| Poaceae | <i>Bromus</i> | <i>japonicus</i> | | Japanese brome, Japanese chess |
| Poaceae | <i>Bromus</i> | <i>marginatus</i> | | mountain brome |
| Poaceae | <i>Bromus</i> | <i>secalinus</i> | | cheat, chess |
| Poaceae | <i>Bromus</i> | <i>tectorum</i> | | downy brome |
| Poaceae | <i>Cenchrus</i> | <i>ciliaris</i> | | hairy buffelgrass |
| Poaceae | <i>Cenchrus</i> | <i>incertus</i> | | coast sandbur, field sandbur |
| Poaceae | <i>Chloris</i> | <i>gayana</i> | | rhodesgrass |
| Poaceae | <i>Cynodon</i> | <i>dactylon</i> | var. <i>aridus</i> | giant bermudagrass |
| Poaceae | <i>Cynodon</i> | <i>dactylon</i> | var. <i>dactylon</i> | bermudagrass |
| Poaceae | <i>Cynosurus</i> | <i>cristatus</i> | | crested dogtail |
| Poaceae | <i>Dactylis</i> | <i>glomerata</i> | | orchardgrass |
| Poaceae | <i>Digitaria</i> | <i>ischaemum</i> | | smooth crabgrass |
| Poaceae | <i>Digitaria</i> | <i>sanguinalis</i> | | hairy crabgrass, large crabgrass |
| Poaceae | <i>Echinochloa</i> | <i>crus-galli</i> | | barnyardgrass |
| Poaceae | <i>Eleusine</i> | <i>indica</i> | | goosegrass |
| Poaceae | <i>Elymus</i> | <i>canadensis</i> | | Canada wildrye |
| Poaceae | <i>Elymus</i> | <i>lanceolatus</i> | subsp. <i>lanceolatus</i> | streambank wheatgrass, thickspike wheatgrass |
| Poaceae | <i>Elymus</i> | <i>trachycaulus</i> | subsp. <i>trachycaulus</i> | slender wheatgrass |
| Poaceae | <i>Elymus</i> | <i>virginicus</i> | | Virginia wildrye |
| Poaceae | <i>Elytrigia</i> | <i>elongata</i> | | tall wheatgrass |
| Poaceae | <i>Elytrigia</i> | <i>repens</i> | | quackgrass |
| Poaceae | <i>Eragrostis</i> | <i>cilianensis</i> | | strong-scented stinkgrass |
| Poaceae | <i>Eragrostis</i> | <i>curvula</i> | | Boer lovegrass, weeping lovegrass |
| Poaceae | <i>Eragrostis</i> | <i>trichodes</i> | | sand lovegrass |
| Poaceae | <i>Eremochloa</i> | <i>ophiuroides</i> | | centipede grass |
| Poaceae | <i>Eriochloa</i> | <i>aristata</i> | | bearded cupgrass |
| Poaceae | <i>Festuca</i> | <i>arundinacea</i> | | tall fescue |
| Poaceae | <i>Festuca</i> | <i>brevipila</i> | | hard fescue |
| Poaceae | <i>Festuca</i> | <i>rubra</i> | subsp. <i>rubra</i> | creeping red fescue, red fescue |
| Poaceae | <i>Glyceria</i> | <i>fluitans</i> | | water mannagrass |
| Poaceae | <i>Glyceria</i> | <i>grandis</i> | | American mannagrass |
| Poaceae | <i>Holcus</i> | <i>lanatus</i> | | velvetgrass |
| Poaceae | <i>Hordeum</i> | <i>jubatum</i> | | foxtail barley, squirreltail barley |
| Poaceae | <i>Hordeum</i> | <i>vulgare</i> | subsp. <i>vulgare</i> | barley |
| Poaceae | <i>Leptochloa</i> | <i>dubia</i> | | green sprangletop |
| Poaceae | <i>Lolium</i> | <i>multiflorum</i> | | annual ryegrass, italian ryegrass |
| Poaceae | <i>Lolium</i> | <i>perenne</i> | | perennial ryegrass |
| Poaceae | <i>Lolium</i> | <i>persicum</i> | | Persian darnel, Persian ryegrass |
| Poaceae | <i>Lolium</i> | <i>temulentum</i> | | darnel, poison ryegrass |
| Poaceae | <i>Megathyrsus</i> | <i>maximum</i> | | guineagrass |
| Poaceae | <i>Nassella</i> | <i>trichotoma</i> | | serrated tussock |
| Poaceae | <i>Nassella</i> | <i>viridula</i> | | green needlegrass |
| Poaceae | <i>Oryza</i> | <i>sativa</i> | | rice |

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|--------------|------------------------|----------------------|-----------------------------|--------------------------------------------|
| Poaceae | <i>Panicum</i> | <i>capillare</i> | | witchgrass |
| Poaceae | <i>Panicum</i> | <i>miliaceum</i> | subsp. <i>miliaceum</i> | broomcorn millet, proso millet |
| Poaceae | <i>Panicum</i> | <i>miliaceum</i> | subsp. <i>ruderales</i> | wild proso millet |
| Poaceae | <i>Panicum</i> | <i>virgatum</i> | | switchgrass |
| Poaceae | <i>Pascopyrum</i> | <i>smithii</i> | | western wheatgrass |
| Poaceae | <i>Paspalum</i> | <i>dilatatum</i> | | dallisgrass |
| Poaceae | <i>Paspalum</i> | <i>laeve</i> | | field paspalum |
| Poaceae | <i>Paspalum</i> | <i>notatum</i> | | bahiagrass |
| Poaceae | <i>Pennisetum</i> | <i>glaucum</i> | | pearl millet |
| Poaceae | <i>Phalaris</i> | <i>arundinacea</i> | | reed canarygrass |
| Poaceae | <i>Phalaris</i> | <i>canariensis</i> | | canarygrass |
| Poaceae | <i>Phleum</i> | <i>pratense</i> | | timothy |
| Poaceae | <i>Poa</i> | <i>annua</i> | | annual bluegrass |
| Poaceae | <i>Poa</i> | <i>bulbosa</i> | | bulbous bluegrass |
| Poaceae | <i>Poa</i> | <i>compressa</i> | | Canada bluegrass |
| Poaceae | <i>Poa</i> | <i>pratensis</i> | | Kentucky bluegrass |
| Poaceae | <i>Poa</i> | <i>trivialis</i> | | rough bluegrass |
| Poaceae | <i>Psathyrostachys</i> | <i>juncea</i> | | Russian wildrye |
| Poaceae | <i>Pseudoroegneria</i> | <i>spicata</i> | | beardless wheatgrass, bluebunch wheatgrass |
| Poaceae | <i>Schizachyrium</i> | <i>scoparium</i> | | little bluestem |
| Poaceae | <i>Secale</i> | <i>cereale</i> | subsp. <i>cereale</i> | rye |
| Poaceae | <i>Setaria</i> | <i>faberi</i> | | giant foxtail |
| Poaceae | <i>Setaria</i> | <i>italica</i> | | foxtail millet, Italian millet |
| Poaceae | <i>Setaria</i> | <i>parviflora</i> | | knotroot bristlegrass |
| Poaceae | <i>Setaria</i> | <i>pumila</i> | | yellow bristlegrass, yellow foxtail |
| Poaceae | <i>Sorghastrum</i> | <i>nutans</i> | | yellow indiagrass |
| Poaceae | <i>Sorghum</i> | <i>xalmum</i> | | almum sorghum |
| Poaceae | <i>Sorghum</i> | <i>xdrummondii</i> | | sudangrass, sorghum-sudangrass |
| Poaceae | <i>Sorghum</i> | <i>bicolor</i> | | broom corn, milo, shattercane, sorghum |
| Poaceae | <i>Sorghum</i> | <i>halpense</i> | | johnsongrass |
| Poaceae | <i>Sporobolus</i> | <i>airoides</i> | | alkali sacaton |
| Poaceae | <i>Sporobolus</i> | <i>cryptandrus</i> | | sand dropseed |
| Poaceae | <i>Taeniatherum</i> | <i>caput-medusae</i> | subsp. <i>caput-medusae</i> | medusahead, medusahead rye |
| Poaceae | <i>Triticum</i> | <i>aestivum</i> | subsp. <i>aestivum</i> | common wheat |
| Poaceae | <i>Triticum</i> | <i>aestivum</i> | subsp. <i>spelta</i> | spelt |
| Poaceae | <i>Triticum</i> | <i>turgidum</i> | subsp. <i>durum</i> | durum wheat |
| Poaceae | <i>Urochloa</i> | <i>ramosa</i> | | browntop millet |
| Poaceae | <i>Vulpia</i> | <i>myuros</i> | | rattail fescue |
| Poaceae | <i>Vulpia</i> | <i>octoflora</i> | | six-weeks fescue |
| Poaceae | <i>Zea</i> | <i>mays</i> | all types | corn |
| Polygonaceae | <i>Fagopyrum</i> | <i>esculentum</i> | | buckwheat |
| Polygonaceae | <i>Fallopia</i> | <i>convolvulus</i> | | black bindweed, wild buckwheat |
| Polygonaceae | <i>Persicaria</i> | <i>lapathifolium</i> | | pale smartweed |
| Polygonaceae | <i>Polygonum</i> | <i>aviculare</i> | | prostrate knotweed |

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|------------------|----------------------|-----------------------|------------------------|-------------------------------------------------------------|
| Polygonaceae | <i>Rheum</i> | <i>xhybridum</i> | | rhubarb |
| Polygonaceae | <i>Rumex</i> | <i>acetosa</i> | | sorrel, garden sorrel |
| Polygonaceae | <i>Rumex</i> | <i>acetosella</i> | | red sorrel, sheep sorrel |
| Polygonaceae | <i>Rumex</i> | <i>crispus</i> | | curly dock, sour dock |
| Primulaceae | <i>Anagallis</i> | <i>arvensis</i> | | scarlet pimpernel |
| Primulaceae | <i>Primula</i> | <i>xpolyantha</i> | | polyanthus |
| Ranunculaceae | <i>Ranunculus</i> | <i>abortivus</i> | | small-flower buttercup, small-flower crowfoot |
| Rosaceae | <i>Potentilla</i> | <i>tridentata</i> | | three-toothed cinquefoil |
| Rosaceae | <i>Rosa</i> | <i>multiflora</i> | | multiflora rose |
| Rosaceae | <i>Rubus</i> | <i>spp.</i> | | blackberry, raspberry |
| Rubiaceae | <i>Galium</i> | <i>aparine</i> | | cleavers, galium |
| Rubiaceae | <i>Sherardia</i> | <i>arvensis</i> | | field madder |
| Sapindaceae | <i>Cardiospermum</i> | <i>halicacabum</i> | | ballonvine, heartseed |
| Scrophulariaceae | <i>Veronica</i> | <i>officinalis</i> | | common speedwell |
| Solanaceae | <i>Capsicum</i> | <i>annuum</i> | | pepper |
| Solanaceae | <i>Datura</i> | <i>stramonium</i> | | jimsonweed |
| Solanaceae | <i>Lycopersicon</i> | <i>esculentum</i> | var. <i>esculentum</i> | tomato |
| Solanaceae | <i>Nicotiana</i> | <i>tabacum</i> | | tobacco |
| Solanaceae | <i>Physalis</i> | <i>alkekengi</i> | | chinese lanternplant |
| Solanaceae | <i>Solanum</i> | <i>elaeagnifolium</i> | | white horsenettle, purple nightshade, silverleaf nightshade |
| Solanaceae | <i>Solanum</i> | <i>melongena</i> | | eggplant |
| Solanaceae | <i>Solanum</i> | <i>nigrum</i> | | black nightshade |
| Solanaceae | <i>Solanum</i> | <i>ptychanthum</i> | | eastern black nightshade |
| Solanaceae | <i>Solanum</i> | <i>rostratum</i> | | buffalobur |
| Verbenaceae | <i>Verbena</i> | <i>stricta</i> | | hoary vervain, woolly vervain |
| Zygophyllaceae | <i>Tribulus</i> | <i>terrestris</i> | | puncturevine |

APPENDIX B, ACRONYMS AND DEFINITIONS

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 who 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://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr;sid=d973d2acda9ebaa05b104480e79c1a71;rgn=div5;view=text;node=7%3A3.1.1.1.11;idno=7;cc=ecfr>)

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.

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/about.html>)

APHIS Animal and Plant Health Inspection Service

Agency of USDA which now 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 1993 to represent the interests of the seed industry in lobbying for favorable legislation at the federal and state levels. (source: <http://www.amseed.com/about.asp>)

CAST Council for Agricultural Science and Technology

A group that assembles, interprets, and communicates credible, science-

based information concerning agriculture and technology regionally, nationally, and internationally to legislators, regulators, policymakers, the media, the private sector, and the public. (source: <http://www.cast-science.org/>)

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/english/agen/val/vale.shtml>)

CSA **Certified Seed Analyst**

Certified affiliate member of an Association of Official Seed Analysts laboratory. (source: <http://aosaseed.com/>)

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.com/CSAAC%20By-laws2002.doc>)

CSGA **Canadian Seed Growers Association**

The Canadian organization that monitors and certifies pedigreed seed for all agricultural crops in Canada (except potatoes.) (source: http://www.seedgrowers.ca/about_us/index.asp?lang=e)

CSTA **Canadian Seed Trade Association**

An association that represents corporate members engaged in all aspects of seed research, production and marketing, both in Canada and internationally. (source: <http://cdnseed.org/>)

EC **European Commission**

A commission of the European Union who upholds the interest of the European Union as a whole. It drafts proposals for new European laws, which it presents to the European Parliament and the Council. (source: http://europa.eu/institutions/inst/comm/index_en.htm)

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.

promote the American agricultural industry, while protecting consumers and the environment. (source: <http://www.nasda.org/cm/7192.aspx>)

NCCPB National Council of Commercial Plant Breeders

An organization of plant breeders, whose council represents the interests of its member companies in the business of plant improvement for feed, food, and fiber. (source: http://www.nccpb.org/abt_whoare.html)

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/general2.htm)

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>)

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/science/PVPO/PVPO_Act/PVPA.htm)

RGT Registered Genetic Technologist

Individuals actively involved in the field of genetic seed testing who have fulfilled the requirements for membership and passed three of the four RGT exams (PCR, ELISA, Electrophoresis and Herbicide Bioassay) (source: <http://www.seedtechnology.net/membership.htm>)

RST Registered Seed Technologist

A member of the Society of Commercial Seed Technologists who is accredited in both purity and germination testing. (source: <http://www.seedtechnology.net/membership.htm>)

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.isco.purdue.edu/seed/index_seed.htm)

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/>)

Title V **Title Five of the Federal Seed Act**

A provision of the Federal Seed 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 chose to be sold only as a class of certified seed. (source:

<http://www.ext.colostate.edu/pubs/crops/00301.html>)

UPOV **International Union for Protection of New Varieties**

Organizations of PVP agencies of 64 countries. (source:

<http://www.upov.int/en/about/members/pdf/pub423.pdf>)

APPENDIX C. DEFINITIONS

DEFINITIONS – GENERAL BOTANY

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

Achene. A dry, hard, one-chambered, one-seeded indehiscent fruit, as in buckwheat, sunflower and spinach.

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).

Anther. The pollen-bearing portion of a stamen.

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

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

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.

Bract. A modified, usually small or rudimentary leaf.

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

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

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

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

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

Caruncle. A hardened aril.

Caryopsis. The single-seeded fruit or grain of the grass family (Poaceae); the fruit wall (pericarp) is united with the seed coat (testa).

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

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.

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. 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.

Convex. Curving outward as the surface of a sphere.

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).

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

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.

Dimorphic. An object having two forms.

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

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

Drupe. A 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.

Elliptic. Oval-shaped.

Embryo. A rudimentary plant contained in a seed.

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 binucleate central cell.

Embryonic axis. The main stem of the embryo.

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.

Epicotyl. The upper portion of the axis of an embryo or seedling above the point where the cotyledon(s), are attached.

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

Filament. The stalk of an anther.

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

Floret. A flower within an inflorescence or in a grass spikelet.

Flower. The reproductive structure in angiosperms.

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

Fruit. In angiosperms, a mature ripened ovary, usually containing seeds.

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

Fusiform. 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.

Glabrous. Without hairs.

Glumes. The bract(s) subtending the floret(s) in most grasses.

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

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

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

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.

Hypocotyl. The part of the embryo or seedling axis between the cotyledons and the radicle.

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 open at maturity.

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.

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.

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

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.

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.

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.

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.

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

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

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

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

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).

Nutlet. A one-seeded portion of a fruit that fragments at maturity.

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.

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.

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.

Palea. The upper 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.

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.

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

Perianth. A collective term for sepals and petals together.

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.

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

Petiole. The stalk of a leaf.

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.

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.

Primary leaf. The first leaf or leaves above the cotyledons.

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

Pubescent. Covered with short, soft hairs.

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

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 spikelet.

Rachis. The main axis of an inflorescence.

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

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.

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

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

Reticulate. Covered with net-like lines.

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

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

Samara. A single-seeded, indehiscent fruit, having a winglike 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*).

Schizocarp. A fruit that splits up at maturity into two equal halves (mericarps) containing one seed each as in the carrot family.

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

Scutellum. The cotyledon of a grass embryo, specialized in absorption of endosperm.

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

Seminal roots. Roots that arise from the embryo.

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.

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.

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

Spikelet. One or more attached grass florets usually subtended by one or two glumes.

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

Staminate. Male-flowered, lacking female reproductive organs.

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.

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.

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

Terminal bud. The shoot apex enveloped by several more or less differentiated leaves.

Testa. See seed coat.

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

Trigonous. Triangular in cross-section.

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.

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.

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

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

DEFINITIONS – GERMINATION/VIGOR/SPECIAL TESTING

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 (see normal seedling).

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.

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.

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

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.

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.

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.

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.

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

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.

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. Delayed germination or growth; a condition of inactivity.

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

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.

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.

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

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

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

Field emergence. The establishment of seedlings in the field.

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.

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.

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

Geotropism. Plant growth response to gravity.

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

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.

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.

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.

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.

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.

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

Imbibition. Water uptake by a seed.

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

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.

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

Inhibitor. A chemical substance that retards or prevents germination.

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

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.

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

Morphophysiological dormancy. Dormancy combining embryo immaturity and physiological dormancy.

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).

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).

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.

Pelleted seed. A substance applied to the seed that obscures its shape with the objective of enhancing precision planting and accurate placement of the seed in the soil by mechanical planters.

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.

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.

Potassium nitrate (KNO₃). A chemical used to increase membrane permeability. In animal research, potassium increases membrane permeability and sodium decreases membrane permeability. The nitrate increases stem elongation and shortens roots.

Prechill. The practice of exposing imbibed seeds to cool (5-10°C) temperature conditions for a few days prior to germination at warmer conditions.

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

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.

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

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

Scarification. The process of mechanically or chemically abrading a seed coat to make it more permeable to water and gases to hasten 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*).

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

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 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 adherent structures.

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.

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.

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.

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.

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.

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

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.

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.

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.

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

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.

DEFINITIONS - PURITY

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.

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).

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).

International Code of Botanical Nomenclature (ICBN). Specific principles, rules and recommendations regarding scientific names of plants.

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.

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.

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.

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.

Pelleted seed. Raw 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 and improved plantability or singulation.

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

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 germination 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.

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.

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

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

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

Vernacular name. Common name.

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. gametes

DEFINITIONS - QUALITY

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

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

APPENDIX D. INSTRUCTIONS FOR TUTORIAL PROGRAM

Section I Suggestions for a Tutorial Program. Tutors are encouraged to set up their own outline for instructing students.

Section II Thoughts on Tutoring

Section III Quarterly Report (13 weeks) must be filled out and returned to the Executive Director within two weeks of completion of each quarter.

Section IV Verification by Tutor of student's time spent under **direct** supervision of Tutor and to affirm that the student qualifies for 1 point for each 160 hours of training. Form must be returned to the Executive Director as soon as possible after training has been completed.

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

**Anita Hall
SCST Executive Director
101 East State St., #214
Ithaca, NY 14850
Phone/fax: 607-256-3313
Email: scst@twcnny.rr.com**

SECTION I

SUGGESTIONS FOR A TUTORIAL PROGRAM

Object:

To help applicants obtain points for RST. Membership through a tutorial program supervised by a qualified tutor.

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 RST 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 at least in the first quarter. 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.

Purity:

The rules should be studied and the tutor should make up questions to be answered. Learn about equipment both old and new. Samples of seed should be made up for the trainee to work. Then the results should be checked. At least one sample every two weeks.

Identification of seeds should be done every week. Learn the characteristics of seeds according to family. A herbarium should be started. Samples should be sent from time to time for identification. Identification should not be taken for granted as that is the basis for Seed Technology.

Germination:

Study normal and abnormal seedlings. Learn the difference between monocotyledon and dicotyledon seedlings. The seedlings in each family bear similarities. Abnormal should be noted as well as what causes the abnormality. Samples should be sent to the candidate and the results recorded. Learn about when to use different germ temperatures and methods for germination. Learn about the different substrata used in germination tests.

Special Studies:

Study tolerances in the rules and work out problems pertaining to them.

Vigor Testing:

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

Tetrazolium Testing

Study the AOSA Tetrazolium Testing Handbook, 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 P.V.P. Act, and types of tests.

Blowing Procedure: Study at tutor's lab or at accredited seed school or workshop.

Fluorescence Tests: Study at tutor's lab or at accredited seed school or workshop.

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:

Pat Conine

USDA-ARS-NATIONAL CENTER FOR GENETIC RESOURCE PRESERVATION
1111 S. Mason Street
Ft. Collins, CO 80521-4500
(970) 495-3239
Email: patricia.conine@ars.usda.gov

The SCST Seed Technologist Training Manual is an essential study tool in which to work from during the training program. It is thorough and would be useful in following a good study format. It may be obtained from SCST 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 Canadian Seed Acts and Regulations as well as the Canadian Methods and Procedures for Seed Testing. These may be obtained from: Canadian Laboratory Services Division, Agriculture Canada, Ottawa.

Suggested Reading:

Technique of Purity Analysis, Emma Sirrine and A. Winnifred Anderson, 1940.
Contribution to the Handbook of Seed Testing by AOSA.

Equipment for Purity Tests, George A. Elliott

Sources of Variation in Purity Analysis, Purity Analysis, Size of Sample, Accuracy of Test and Tolerance, C.W. Leggett, 1942

The Identification of Seeds, Generic, Specific, and Varietal, Albina Musil

Testing Agricultural and Vegetable Seeds, Handbook 30

Identification of Crop and Weed Seeds, Handbook 219

Plant Structure and Function, Mini Course Develop. Project, W.B. Saunders Co.

Handbook for Seedling Evaluation, AOSA Handbook Contribution 35.

Handbook for Seedling Evaluation, ISTA.

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

Separation of Immature Seed of Trifolium Repens - White Clover and Trifolium Hybridum - Alsike Clover, Merle Weisner (AOSA Proc. 32 Annual Meeting)

The Excised Embryo Method of Testing Germination Quality of Dormant Seed, AOSA Proc. 45:108-117.

Seed Viability and Viability Testing, 103-120 Chapter V.
Principles of Seed, Science, and Technology, L.O. Copeland, 1976.

An Introduction to Seed Technology, J.R. Thomson. Read Chapter III
(Development, Ripening, Dormancy and Germination)

Seed Herbarium, Aleta Meyr (1976). A help in organization of your Herbarium.

Effects of Temperature, Relative Humidity, and Protective Packaging on
Longevity of Peanut Seeds, Louis Bass, AOSA Proc. Vol. 58, 1968, PP. 58-63.

Opportunities for Progress in Seed Germination Testing, Don F. Grabe, AOSA
Proc. 58: 1968, PP 63-70.

Merits of Different Vigor Tests, R.P. Moore, AOSA Proc. 58, 1968, PP 89-95.

Tetrazolium Seed Testing Development in North America, R.P. Moore, Journal of
Seed Technology, Vol. 1, 1976, PP 17-30.

The Weibull Function: A New Method of Comparing Seed Vigor, F.T. Bonner,
and T.R. Dell, Journal of Seed Technology, Vol. 1, 1976 PP 96-103.

Mechanical Seed Identification, Charles R. Gunn, Journal of Seed Technology,
Vol. 2, 1977, PP. 30-39.

Seed/Seedling Vigor and Field Performance, J.S. Burris, Journal of Seed
Technology, Vol. 1, No. 2, 1976, PP 58-74.

Standardization of Vigor Tests, J.C. DeLouche, Journal of Seed Technology, Vol.
1, No. 2, 1976, PP 75-85.

Predicting the Storability of Soybean Seed Lots, Charles C. Baskin and Edson
H.N. Vierra. Journal of Seed Technology Vol. 5, No. 2, 1980, PP 1-6.

Influence of Amount of Water in Paper Towel on Standard Germination Tests,
Bangalore Phaneendranath, Journal of Seed Technology, Vol. 1, 1976, PP 82-
87.

An Evaluation of Alternative Methods of Accelerated Aging Seed Vigor Test for
Soybeans, Kar-Ling J. Tao, Journal of Seed Technology, Vol. 3, 1978, PP 30-40.

The Influence of Seed Moisture on A.A. Seed Vigor Test, M.B. McDonald, Jr.
Seed, Science, and Technology, Vol. 2, No. 1, 1977, PP 18-28.

Evaluation of the Velvet Roll Separator for its Use in the Analysis of Alfalfa and
Rapeseed, M>S> Dhaliwal and F.J. Lewis, AOSA Proc.65: 1975, PP 147-153.

Effect of Fungicide Seed Treatment on Soybean Germination and Field
Emergence, D.M. TeKrony, D.B. Egli, A. Phillips, and T.W. Still, AOSA Proc.64:
1974, PP 80-89.

Germination Response of Soybean Seeds with Damage Seed Coats, AOSA Proc. 64: 1974, PP 115-119.

Effect of Seed Vigor on Field Performance and Yield of Grain Sorghum, C.P. Camargo and C.E. Vaughn, AOSA Proc. 63: 1973, PP 135-147.

Field Deterioration of Soybeans as Affected by Environment, Rene Mondragon and H.C. Potts, AOSA Proc. 64: 1974, PP 63-71.

A Procedure for Determining Viability of Dormant Peanut Seeds, L.E. Clark, AOSA Proc.61: 1971, PP 58-67.

Laboratory Techniques for Distinguishing Winter Wheat Cultivars, N.S. Dhesi, R.W. Desormenux, and J. Pouksens. AOSA Proc. 6: 1971, PP 91-98.

Deterioration of Soybean Seed in Storage, H.W. Byrd and James C. DeLouche, AOSA Proc. 61: 1971, PP 41-57.

Seedling Vigor in Soybeans, O.T. Edje, J.S. Burriss, AOSA Proc. 60: 1970, PP 149-157.

The Development of Quicker Germination Tests, W.T. Bradnock, Janie Matheson and Marie Fodorwicz, AOSA Proc. 60: 1970, PP 213-218.

Tetrazolium Seed Testing Aids, R.P. Moore, AOSA Proc. 60: 1970, PP 100-103.

Tetrazolium Evaluation of the Nature and Progress of Deterioration of Peanut Seed in Storage, C.E. Vaughan, R.P. Moore, AOSA Proc. 60: 1970, PP 104-117.

Some New Tests and Procedures for Determining Variety (Soybeans), Richard C. Payne, Journal of Seed Technology, Vol. 3, 1978, PP 61-77.

Evaluation of Alternate Substrate Temperature and Moisture Levels of Soybean Seed Germination, Lori Rigdon and Miller B. McDonald, AOSA Newsletter, Vol. 55, No. 1, 1981, PP 54-61.

A Test to Determine the Amount of Moisture Used in Germinating a Sample of Peanuts, Luther Butler, AOSA Newsletter, Vol. 55, No. 31981, PP 55-58.

Identification of Wheat and Barley Varieties at Seedling Stage, N.S. Dhesi, R.W. Desormeaux, and J. Pauksens. AOSA Proc. 59: PP 124-141.

Relationship Between Germination, Vigor, and Field Emergence in Alfalfa Seed, Arnold Larsen, Duane Isely, AOSA Proc. 57: 1967, PP 60-67.

Effects of Light, Temperature and Their Interactions on the Germination of Seeds, V.K. Toole, Vol. 1, No. 2, 1973, PP 339-396.

The articles listed should give the trainee an idea of source material from the Association of Official Seed Analysts. An Index of the Proceedings are available published in 1939, 1961 (Vol. 50, No. 2) 1960-1975 Vol. 6, 1981 No. 1.

Trainees should become SCST Associate Members in order to receive the SCST/AOSA joint newsletter. The seed trade also has magazines that can be of value to keep them up-to-date.

Acknowledgment to:

Cecilia Kollack

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Gail Fenderson

Jean Pawek

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.

1. 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 can not 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 some one 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 abnormals; 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 (in the spring) before the exam, they are reading the rules every night.
5. As we start learning germination abnormals, 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, again we start with clean samples. Gradually we add simple to find, common weeds. We start with the federally listed noxious weeds. Then we move on to the most common noxious weeds. Gradually we add look alike 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 their 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

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. All issues of the AOSA and SCST Newsletters published in a 12 month period must be read. These may be included in assigned reading material.
4. At least two weeks (10 days) per year must be under the direct supervision of the tutor.

5. 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

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 Mo Da Yr _____ To Mo Da Yr _____

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 \$ 50 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

- G. 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;

- H. 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.

- I. 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.

- J. 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.

- K. 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:

- L. 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 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.

S 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

REFERENCE MATERIAL- Current editions required

| | |
|--------------------------------------------|-----------------------------------------------------------------------------------|
| Analytical Balance | AOSA Rules for Testing Seeds. (updated annually) |
| Fluorescence Equipment* | AOSA Seedling Evaluation Handbook #35 (updated annually) |
| Forceps (Tweezers) | AOSA Uniform Classification of Crop and Weed Seed Handbook #25 (updated annually) |
| Microscope | AOSA Tetrazolium Handbook. (updated annually) |
| Germination Media/Equipment | AOSA Vigor Testing Methods. Handbook #32 (updated 2002) |
| Hand Lens (minimum 7x) | AOSA Cultivar Purity Handbook (updated 2004) |
| Light Magnification | Rules and Regulations under the Federal Seed Act (current edition) |
| Mechanical Blower (May be crop specific)** | Current All State Noxious Weed Requirements. USDA |
| Mechanical Divider | Current State Seed Law and Regulations |
| Prechill Chamber *** | Reference Seed Herbarium/Collection. (Minimum 150 kinds) |
| Purity Board | A good reliable Botany Text. |
| Record/Reporting Forms | |
| Sample Storage Facilities | |

*Used for cultivar testing **Where grasses are tested ***For those crops tested which require prechilling

EQUIPMENT AND REFERENCE MATERIAL SUGGESTED BY THE EXECUTIVE BOARD

EQUIPMENT

Exhaust System
NIST Thermometer

REFERENCE MATERIAL

MSDS Information
RST Study Guide (available from the SCST website)
Seed Technologist Training Manual. (SCST 2005)
International Rules for Seed Testing. (updated annually)
Methods and Procedures for Testing Seed.
Canadian Food Inspection Agency.
Seed Act Regulations of Canada.
Canadian Food Inspection Agency.
Principles and Practices of Seed Technology. Text book by Dr. Larry Copeland & Dr. McDonald
Identification of Crops and Weed Seeds.
USDA Handbook #219
Testing Agriculture and Vegetable Seeds.
USDA Handbook #30

Contact the SCST Executive Director if you need assistance in obtaining reference materials.