

Introduction

1. Give a few facts concerning the history and scope of seed testing. By scope include:
 - a) The rules and laws under which we operate.
 - b) Type and functions of laboratories.
(1961 Yearbook of Agriculture, page 408 and pages 1 and 2 of USDA Handbook #30)
2. Why are rules for seed testing important? (AOSA Rules - Introduction)
3. Seed Testing provides information for: (USDA Handbook #30 - Page 1)
 - (a)
 - (b)
 - (c)
 - (d)
4. If a sample requires special treatment or any deviation from the rules, how should this be handled? = AOSA Rules - Introduction

5. What do you consider the qualifications of a good seed analyst? (1961 Yearbook of Agriculture - Page 412).


 6. If you were given the job of setting up a small laboratory for a seed company that handled a variety of crop and vegetable seeds:
 - a) What equipment would you consider necessary?

 - b) What working conditions would you select as best for light?

 - c) What reference material would you consider a minimum?

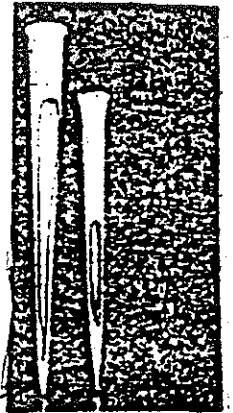
 - d) How long would you keep samples on file after testing and what conditions would you consider the best for the storage of these samples.

 - e) What information would you consider necessary to include on your report forms?

 - f) What requirements would you make for laboratory sanitation and health protection?
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Sampling

1. What is the ultimate purpose in making the seed test?
(AOSA Rules - Introduction)
2. Why should the analyst be familiar with sampling procedures?
(AOSA Rules 1 Sampling)
3. Define "lot of seed". (Agriculture Yearbook 1961 - Page 415)
4. How do you secure a representative sample
(AOSA Rules 1.1 Sampling)?
5. What is the procedure for sampling non-free flowing seed?
(AOSA Rules 1.1 - Sampling)
6. What is the procedure for sampling free flowing seed?
(AOSA Rules 1.1 - Sampling)
7. What is the importance of individual bag samples?
(AOSA Rules 1.1 Sampling and Agriculture Yearbook 1961, page 416).
8. How do you sample a lot of seed to test for uniformity?
(AOSA Rules 1.4b)
9. Describe the construction and use of a good trier. (AOSA Rules 1.2)
10. What is the chief fault in using a thief trier?
(Agriculture Yearbook 1961 - Page 415)



two thief-type triers that are not recommended



Sleeve-type seed and grain triers.

11. How can seeds be sampled during the cleaning and bulking process? (AOSA Rules 1.3b and Agriculture Yearbook 1961 - Page 415.)

12. How may a farmer without equipment take a sample? (Agriculture Yearbook 1961, Page 416).

13. In sampling boxes of beans, what amount do you take? [(AOSA Rules 1.4 (5)]

14. How many bags should be sampled in lots of the following:

6 bags

10 bags

250 bags

[AOSA Rules 1.3 (3)]

15. What are the approximate sizes for composite samples? (AOSA Rules 1.4a)

Weights

1. In weighing samples of greatly different weights, how is the number of significant figures determined?
2. How much difference is allowed between the original and final weight?
3. Describe the procedure in calculating component parts of a sample weighting as follows:
 - a) less than 25 grams
 - b) more than 25 grams
4. What is the procedure in separating two or more similar varieties which are difficult to distinguish in a sample?
5. Should the size of the working sample be changed from the prescribed amount in the rules?
6. On what approximate number of seed is the weight of a purity test determined?
7. You are making a purity analysis on a kind of seed for which there is no recommended weight for the working sample. How do you determine the proper weight for your working sample?

Origin

1. Why is it important to know the origin of some kinds of field seed? (Agriculture Yearbook 1961, page 423).
2. How does the Federal Seed Act regulate the importation of alfalfa and red clover from foreign countries? Why is this necessary?
3. Under the Federal Seed Act what kinds of seed must be labeled as to origin? (Page 23, 201.5 origin)
4. How may origin be determined by impurities? (Handbook 30, page 175).

Sample Mixing

- iii) A container is placed under each spout.
- iv) The whole sample is fed into the hopper. When filling the hopper, seed must always be poured centrally.
- v) The spinner is operated, and the seed passes into the containers.
- vi) Full containers are replaced by empty containers. The contents of the two full containers are fed into the hopper together, the seed being allowed to blend as it flows in. The spinner is operated.
- vii) The procedure described in (vi) above is repeated at least once more.

Sample Reduction

- viii) Full containers are replaced by empty containers. The contents of one full container are set aside, and the contents of the other are fed into the hopper. The spinner is operated.
- ix) This procedure is repeated until the appropriate size of working sample is reached.

Purity

1. What is considered the seed unit? (AOSA Rules 2.6)
2. What publications govern the classification of weed & crop seed?
3. The seed or "seed-like" structures of the following families are characterized below. Choose from them to answer the following three descriptions.

Gramineae (Grass Family)
Leguminosae (Legume Family)
Polygonaceae (Smartweed Family)
Chenopodiaceae (Goosefoot Family)
Compositae (Sunflower Family)

a) "Seeds", one-seeded fruits typically bearing a cluster of hairs or bristles at the top.

b) "Seeds", one-seeded fruits usually enclosed by a pair of bracts known as the lemma and palea.

c) "Seeds", a one-seeded fruit (achene), flattened or three-angled, usually pointed at the upper end, surface hard, frequently shiny, usually smooth.
4. What grasses are considered chaffy grasses under the rules for seed testing. (AOSA Rules 5.2A page 78)
5. In making a purity test, on which grasses would you not remove the sterile florets from the fertile ones? (AOSA rules 2.12)
6. Would you consider a ryegrass as crop or inert if over half of the root shoot axis of the embryo was missing? (AOSA rules 2.7B).

7. Would you consider a quackgrass weed seed or inert if over half of the root shoot axis of the embryo was missing [AOSA rules 2.10 (B2)].
8. What is an involucre? (USDA handbook 30 - glossary.)
9. What is a pericarp?
10. Why are damaged food seeds classified differently than damaged crop seeds? (U.S. Yearbook Agriculture 1961, pages 418-419).
11. Illustrate the position of the embryo in *Cuscuta* spp. *Rumex* spp., cruciferae and in *Polygonum* spp. Why is it important to know this position?
12. What are stone cell bodies? What noxious weed can they be confused with? (See USDA Handbook 30, illus. 622)
13. How can you prove a structure is a nematode gall? What kinds of grasses tend to be infested with nematode galls? How do you recognize them? (Pages 54, 62, 63 in USDA Handbook 30.)

14. What is a sporocarp?
15. Under what condition may different kinds & varieties present to the extent of 5% or less be considered as pure seeds? (AOSA Rules 2.7 page 23.)
16. Define pure seed.
17. **Check which are** to be considered ***pure crop seed*** and ***weed seeds*** or ***inert matter***.
 - a. Seed balls of beets.
 - b. Small fragments of beet balls obviously empty.
 - c. Blind diseased ryegrass.
 - d. Empty sunflower seed (when crop or weed) (AOSA Rules 2.7 - 2.10).
 - e. Nematode galls.
 - f. Chalcid fly damaged seed.
 - g. Weevil injured vetch, little or no opening in seed coat.
 - h. Seeds of legumes and crucifers with seed coat entirely removed.
 - i. Pieces of broken or damaged crop seeds one-half or less than the original size.

- j. Allium bulblets that show damage to basal end with some seed coat remaining.
- k. Buckhorn seeds black, no brown color evident under 10 x magnification.
- l. Ragweed with only the involucre present.
- m. Immature shriveled and crushed seed of the kind under consideration.
- n. Empty seed of buckwheat.
- o. Multiple florets and entire spikelets of barley, bluegrass and oats.
- p. Seeds that have started to germinate.
- q. Single seeds of Juncus.
- r. Smut balls and fungus bodies.
- s. Seed units of grasses in which the caryopses are spongy or corky.
- t. Immature florets of quackgrass in which the caryopses are less than 1/3 the length of the palea.
- u. Dodder with coiled embryo present.
- v. Ragweed with involucre and pericarp absent.
- w. Empty seeds of pepper and tomato.
- x. Onions large enough to stay on sieve, no skin or damage.
- y. Buckwheat seed without the seed coat.

Purity Dividing

1. What is the proper procedure in dividing samples?
 - a) Mechanically
 - b) By hand
2. Describe the proper use of a Gamet divider.
[Proc. Int. Seed Test. Assoc. Vol. 31 (1966) No. 4]

Centrifugal divider. The centrifugal divider (Gamet type) makes use of centrifugal force to mix and scatter the seeds over the dividing surface. In this divider the seed flows downward through a hopper onto a shallow rubber cup or spinner. Upon rotation of the spinner by an electric motor, the seeds are thrown out by centrifugal force and fall downward. The circle or area where the seeds fall is equally divided into two parts by a stationary baffle so that approximately half the seeds fall in one spout and half in the other spout.

The centrifugal divider tends to give variable results when not carefully operated. However, satisfactory results have been obtained when this divider is operated as described below.

Preparation of Apparatus

- (i) The divider is leveled by means of the adjustable feet.
- (ii) The divider and four containers are checked for cleanliness.

Purity Methods and Formulas

1. Describe the uniform blowing method.
2. For what kinds of seed is it used?
3. Describe the alternate method
 - (a) as used for orchardgrass
 - (b) as used for fescue

Calculation of Chaffy Grass Seed Samples Containing Over 5% Multiple Units
Dan Niffenegger

The following example illustrates the calculations to be made to determine the percentages of the various purity components when the alternate method of purity analysis of chaffy grasses is used. The example illustrated is for a crested wheatgrass sample, but the procedure is the same for the other grasses which come under the new rule.

1. Record weights of the components separated by the purity analyst.

Crested Wheat Grass

Single Florets:	2.820 gr.
Multiple Units:	.590
Inert:	1.665
Crop:	.170
Weed:	.030
Total:	5.275

2. Determine percentage of single florets in sample.

$$2.820 \div 5.275 = 53.46\%$$

3. Refer to the Table in section 2.11 - c of the Rules. This gives a factor of 72% to use, since the single floret percentage is between 50.01 and 55.00%.

4. Multiply the factor, 72% by the weight of the multiple units. Answer is the calculated weight of pure seed in the multiple units.

$$.72 \times .590 \text{ grams} = .425 \text{ grams}$$

5. Subtract the calculated weight of pure seed in multiple units from total multiple unit weight to find calculated weight of inert in multiple units.

$$.590 - .425 = .165 \text{ grams}$$

6. Add calculated weight of pure seed in multiple units to single floret weight to find total weight of pure seed. Add calculated weight of inert in multiple units to original inert weight to find total weight of inert.

$$\text{Pure seed weight} = .425 \text{ plus } 2.820 = 3.245 \text{ grams}$$

$$\text{Inert weight} = .165 \text{ plus } 1.665 = 1.830 \text{ grams}$$

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7. Calculate percentages of pure seed, other crop seed, weed seed, and inert matter in usual manner. What calculations have been made, purity work card will show the following information:

Single florets	2.870 grams = 53.46%
Multiple units	.570
Inert	.165 1.665 = 1.830 grams
Pure seed	.425 2.820 = 3.245 grams

Multiple unit factor = 72%

	Weight	Percent
Pure Seed	3.245	61.52
Crop Seed	.170	3.22
Weed Seed	.030	.57
Inert	1.830	34.69
Total:	5.275	100.00

Noxious Weed Seed

1. How are weed seeds spread?
2. What makes weed seeds noxious in certain states? (USDA Yearbook 1961 - Page 422).
3. Name five weeds which are considered to be primary noxious in most states in which they occur.
4. Learn to recognize as many of the noxious weed seeds on the all state list as possible.
5. It is important not only to find the noxious weed in a bulk examination, but also to determine by examination if the seed can be counted as weed or inert.
 - a) What rules apply to the determination of:
 - Dodder:
 - Wild onion bulblets:
 - Johnsongrass:
 - Buckhorn:
 - Quackgrass:

b) Also seeds of the following families:

Cyperaceae:

Polygonaceae:

Convolvulaceae:

Solanaceae:

Asteraceae:

6. In making a bulk examination, when would it be considered unnecessary to remove certain noxious weeds? (AOSA - Page 25 - Section 3.1)

Germination The Germinator

1. What do you consider the specifications for a good germinator?
2. Give a few rules for the care and maintenance of a germinator.
3. What should the relative humidity of the germination chamber be?
4. What are the specifications for light intensity?
5. Give the number of hours for day and night temperature alternations:
_____ Day _____ Night
6. If samples have to be left over a weekend without alternation, what temperature should be used?
7. Give the formula for converting Centigrade to Fahrenheit and vice versa.
8. What deviation from the rules in temperature variation is allowed?

Germination Retesting

1. Figure if retests are necessary on the following 3 x 100 replicates.

a)	92	80	81
b)	80	80	91
c)	91	72	85
d)	90	70	80
e)	90	88	82

2. In cases of 2 x 100 replicates

90	72
82	85
95	65
84	65

3. List other cases in which retests are advisable.

4. How are 100 seed replicates formed from 25 or 50 seed roles?

5. When several tests are made on a lot, which test should be reported and when may a retest by averaged?

Seed Storage and Longevity
(Yearbook of Agriculture 1961 - Pages 345, 356, 358)

1. What effect does temperature and relative humidity have on longevity and vitality of seeds in storage?
2. Describe the best conditions for the warehouse storage of seed.
3. Does temperature have an effect on the moisture content of seed?
4. What are the recommendations concerning desirable temperature and humidity conditions for vegetable seed?
5. If the temperature within storage cannot be controlled, what other measures can be taken to lessen deterioration.
6. Which of the following kinds of seed are known to be short lived.

Red clover
Wheat
Onion Seed
Small Seeded fescue
Peanuts
7. What is the estimated age of the oldest known viable seed? (Agricultural Yearbook - Page 356).

8. If seeds are held in storage until the date a test expires, is a retest of the original file sample considered a reliable basis for determining the percentage of germination and renewing the date of test shown on the labels?

True or False

(Agricultural Yearbook - Pages 95 to 99)

1. Seed coats are important in the longevity of seed.
2. Crop seed have generally thinner seed coats and shorter longevity than weed seeds.
3. ?

Germination Germination Tests and Interpretations

1. In seed laboratory practice, how is germination defined?
2. What conditions are necessary for germination to take place?
3. What activities are started in the seed as it begins to germinate?
4. Name five of the most commonly used constant and alternate germination temperatures. List 5 kinds of seed tested at each.
5. Describe in general a normal monocot and dicot seedling.
6. Define normal seedling.

5. List methods for overcoming dormancy.
6. Give five causes of dormancy.
7. Define hard seed.
8. What causes variation in hard seed content?
9. What kinds of seed contain hard seed?
10. Seeds of legumes, okra and cotton often contain swollen seeds at the end of the germination period. How is this handled?
11. Name some kinds that show firm ungerminated seeds.

7. Define abnormal seedling.
8. List the causes for abnormal seedlings.
9. What special abnormalities would you watch for in counting tests of the following kinds of seed?
Radish:
Watermelon:
Corn:
Sweet Clover:
Onion:
Red Clover:

Germination
Dead Seeds, Dormant Seeds, Swollen Seeds, Hard Seeds
And Firm Ungerminated Seeds

1. How do you differentiate between dead, dormant and swollen seed?
2. What is dormancy?
3. What would lead one to think the seed is dormant?
4. Give three kinds of seeds likely to show dormancy.

Germination Substrata, Spacing and Special Treatments

1. Name the types of specified substrata
2. What are the specifications for germination substrata?
3. Give a simple test for toxicity in germination substrata.
4. Give the formula for moisture of sand.
5. Describe the procedure in making soil and sand tests.
6. What is the general rule for moisture in blotters or other paper substrata for the germination of seed?
7. What is the proper use of a vacuum counter?
8. What is the approximate proper spacing of seed?
9. Give the general rules for counts during the germination period.

10. How many seeds should be tested for germination?
11. Give the source of seed for germination when:
 - a) purity and germ test required
 - b) only germ test asked
 - c) the pure seed appears to be less than 98%.
12. When can only 200 seeds be used for a test?
13. In germination tests, how are multiple seed units such as tests, handled?
14. How should fungi infestation in a test be treated?
15. Give special procedure in testing:
 - a) Alyce Clover
 - b) Bahia Grass
 - c) Beets
 - d) Buffel grass
 - e) Cotton
 - f) Endive
 - d) Lettuce
 - h) Rice

16. *True or False*

- a) In Compositae, all ungerminated seed should be examined to determine whether they are empty, dead or dormant.
- b) Although endive are chicory and practically indistinguishable, endive may show extreme dormancy whereas chicory will not.
- c) Citron must be soaked for six hours before being placed for test. Fresh and dormant seed should be tested at 30°.
- d) If dormancy is suspected in millets, remove the glumes and put back in test. If the seed is dead, embryos will turn dark and decay.
- e) Degluming is not specified in the rules for Pensacola Bahia grass.
- f) In barley, oats, rye and wheat the shoot may be spirally twisted provided it is green and has normal length.
- g) Substrata for cucurbits and sorghum should be on the dry side.
- h) Temperature and scarification are present in the rules for overcoming dormancy in legumes.
- i) Hard seeds occur in cotton, okra, clovers, vetch and cowpeas.
- j) Tomato dormancy may be broken by light and KNO₃.
- k) The prechill time should be added to the total time given for germination.

Federal Seed Act

- 1. List the information necessary in keeping a complete record of seed (FSA - Page 7)
- 2. What is meant by the word hybrid? (FSA Page 7 (x)).
- 3. How much must be kept of a sample for reference in interstate shipment?

4. What information is necessary on the label of seed for interstate shipment -- both vegetable & field? (See the Federal Seed Act "In a Nutshell")
5. What are the requirements on imported seed? (See the Federal Seed Act "In a Nutshell" Second Page).
6. Any agricultural or vegetable seed that has been treated must be labeled to show the seed has been _____ and with the _____ (See the Federal Seed Act "In a Nutshell" and Page 27 FSA (201.31a)).
7. How may screenings be shipped in interstate commerce? (FSA - Page 28, sec. 201.32)
8. Name the weeds noxious in importation (Section 201.166 page 69)
9. Define:
 - a) pure live seed. (201.206 page 75)
 - b) kind - (Page 3 B-11)
 - c) variety (Page 3, B-12).
 - d) type (Page 3, B13).
10. Each state has jurisdiction over the seed sold within its boundary.
 - a) With what is the jurisdiction of the Federal Seed Act concerned, and how does it cooperate with state agencies?
 - b) What division of the USDA administers the Federal Seed Act and where is its headquarters?

Federal Seed Act
(Agricultural Yearbook - 1961 - Page 482)

1. It is possible for seed dealers to sell low quality but correctly labeled seed.
2. All state laws require that vegetable seed be labeled as to purity %, germ % and the month and year of test.

3. The label attached to the seed bag is generally required by law to show percentage of pure seed, percentage of weed seed, percentage of other crop seed, percentage of inert matter, percentage of germination, hard seed, name and address of seller or person labeling seed.
4. A variety name can be used as a trade mark or vice versa.
5. Vegetable seeds that are below the specified standard established for germination must be labeled to show percentage of germination, date of germination test and words "Below Standard."
6. Farmers and purchaser cannot collect damages from State or Federal Seed Laws. It provides action only against persons violating the seed law.
7. Quality requirement on imported seed usually requires about 75% pure live seed; however, there are some exceptions.
8. Most state seed laws exempt a farmer from labeling seed he sells on his own farm.
9. A disclaimer clause means a seller can disclaim responsibility for information on the label such as germination and purity percentages.

10. By "processing" is meant any process that changes the purity or germination of the lot. Seed may be shipped bearing the label "Seed for Process" and not carry any other tag but the records of the lot.
11. Complete record of the lot of seed must be kept for five years and must include all records of purity, origin, germination and enough seed for a required test.
12. Alfalfa, red clover, white clover and field corn shall be labeled to show origin, if known. If not known, this should be stated. If the seed has several origins, the states in which they originated shall be given in order.
13. Beets, bluegrass and oats may be transported during July, August and September, before the germination is completed.
14. In interstate shipment only five months may elapse between germ tests.
15. In advertising the name of the seed, it must not be associated with any word to create a misleading impression as to the characteristics of the seed.

Seed Act Regulations of Canada

1. What is the chief difference between the Seed Law Regulations of Canada and those of the United States?
2. Name the prohibited noxious weeds for seeds imported into Canada.
3. In addition to the prohibited weed seeds, for which there is no tolerance, what weeds (or class of weeds) would prevent your firm from exporting to Canada, seed guaranteed "Canada No. 1 Seed?"

Botany General Information

1. Define briefly the following related branches of Botany:
 - a. Applied or Economic Botany
 - b. Systematic Botany (or Taxonomy)
 - c. Plant Morphology
 - d. Histology
 1. Plant Anatomy
 2. Cytology
 - e. Plant Physiology
2. Using the scientific name for corn (*Zea Mays* L.) as an example, describe briefly the binomial system of nomenclature. Who used it first on a large scale? What are the advantages of using scientific rather than common names?

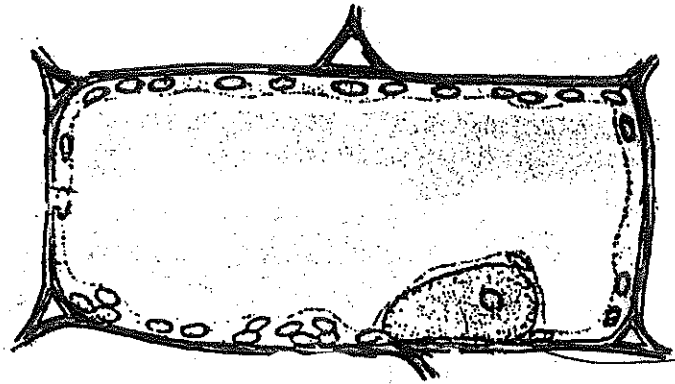
3. Define:
 - a. Annual:
 - b. Winter Annual:
 - c. Biennial:
 - d. Perennial:
4. Classify each of the following as (a) *annual*, (b) *winter annual*, (c) *biennial*, or (d) *perennial*.
 1. Medicago sativa - alfalfa
 2. Lespedeza spp. - lespedeza
 3. Ambrosia spp. -ragweed
 4. Agrostis alba - Redtop
 5. Setaria italica - millet
 6. Melilotus officinalis - yellow sweetclover (Madrid)
 7. Melilotus alba - white sweetclover (Standard)
 8. Festuca spp. - fescues
 9. Cuscuta spp. - dodder
 10. Trifolium incarnatum - Crimson clover
 11. Trifolium pratense - Red Clover
 12. Lolium multiflorum - Italian ryegrass
 13. Phleum pratense - Timothy
 14. Melilotus indica - annual sweetclover or sourclover
 15. Vicia spp. - vetches
5. Select five pairs of the most closely related plants from the following:
 - a. White Clover
 - b. Sugar Cane
 - c. Hollyhock
 - d. Cabbage
 - e. Lespedeza
 - f. Mallow
 - g. Cinquefoil
 - h. Johnson grass
 - i. Rose
 - j. White mustard
6. The turning or other reaction of a plant or of its parts in response to some external stimulus is called _____.
7. A root that is pulled downward by gravity is an example of _____.

8. The tropism of an aerial portion of a plant in response to light is an example of _____.

The Plant Cell

1. The protoplasm of a single cell is called the protoplast. Outline and define briefly the main parts of the protoplast. Including this information, further describe a typical plant cell.

Label:

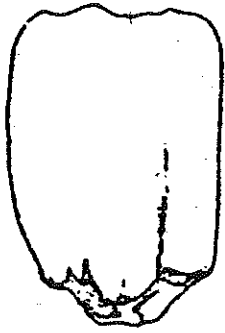


3. Outline the process of mitosis.
4. What changes occur in the following metabolic processes of plants:
- Photosynthesis
 - Respiration
 - Assimilation
 - Digestion
5. What is the importance of chromatin? What are chromosomes?

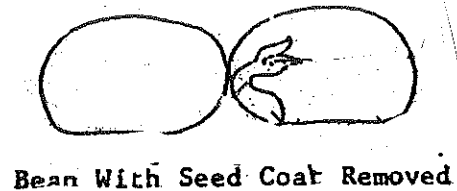
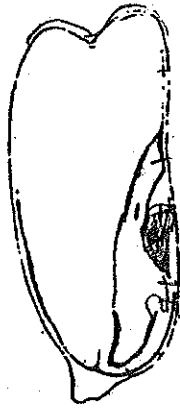
The Seed, Seed Germination, and the Seedling

1. Define (a) seed and (b) seedling.
2. Where is the reserve food supply of a seed stored?

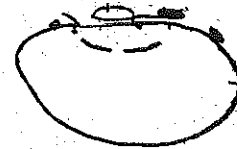
3. Label and define the parts:



Kernel of Corn

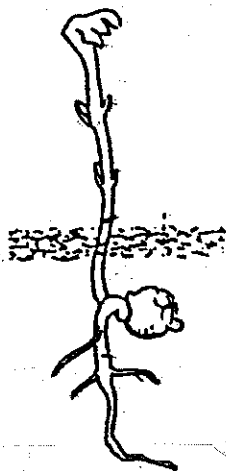


Bean With Seed Coat Removed

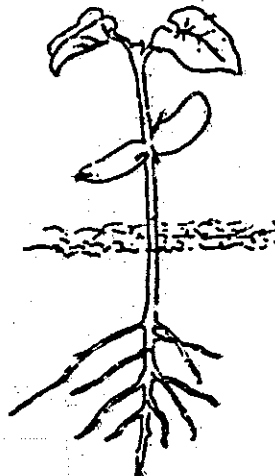


A Young Bean

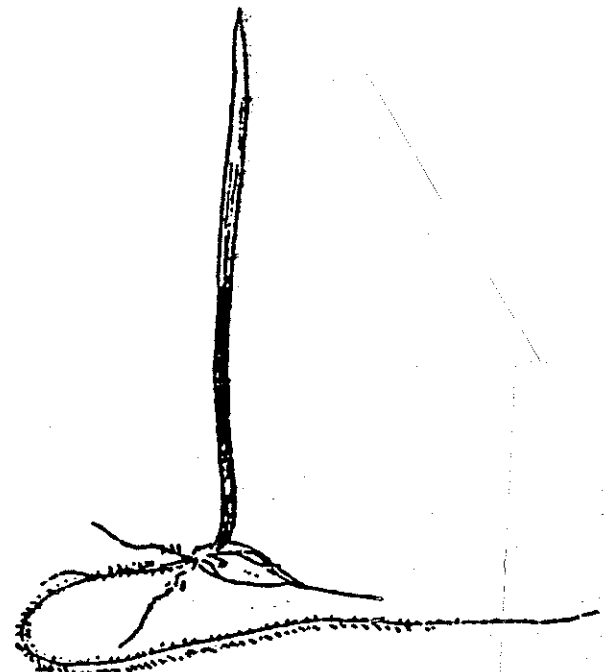
4. What are the main differences between monocotyledons and dicotyledons? (Seed and plant)
5. Temperature, oxygen and moisture are essential for seed germination. Explain the importance of each.
6. Define epigeal germination and hypogeal germination. Classify the following:
- a. Garden bean
 - b. Garden pea
 - c. Corn
 - d. Vetch
 - e. Clover
 - f. Watermelon
7. Label the parts of these seedlings:



Pea Seedling



Bean Seedling



Rye Grass Seedling

*Essential structures of seedlings

Cotyledons: The embryo or seed leaves, usually serving as food-storage organs.

Primary leaves: The first true leaves.

Terminal bud: The growing point of the stem.

Axillary buds: The buds in the axils of cotyledons or leaves.

Hypocotyl: The structure between root and cotyledons, a transition zone between root and stem, the limits of which can be determined only by anatomical sections in many cases.

Epicotyl: The portion above the cotyledons, consisting of the primary leaves, the stem and terminal bud.

Coleoptile: A colorless leaf-like sheath enclosing the first foliage leaf of a grass seedling.

Plumule (in grasses): The coleoptile and first foliage leaf.

Primary roots:

- a. Tap: A permanent root arising from the base of the hypocotyl.
- b. Seminal: roots arising in the region of the scutellar node, usually in pairs, as in the cereals.

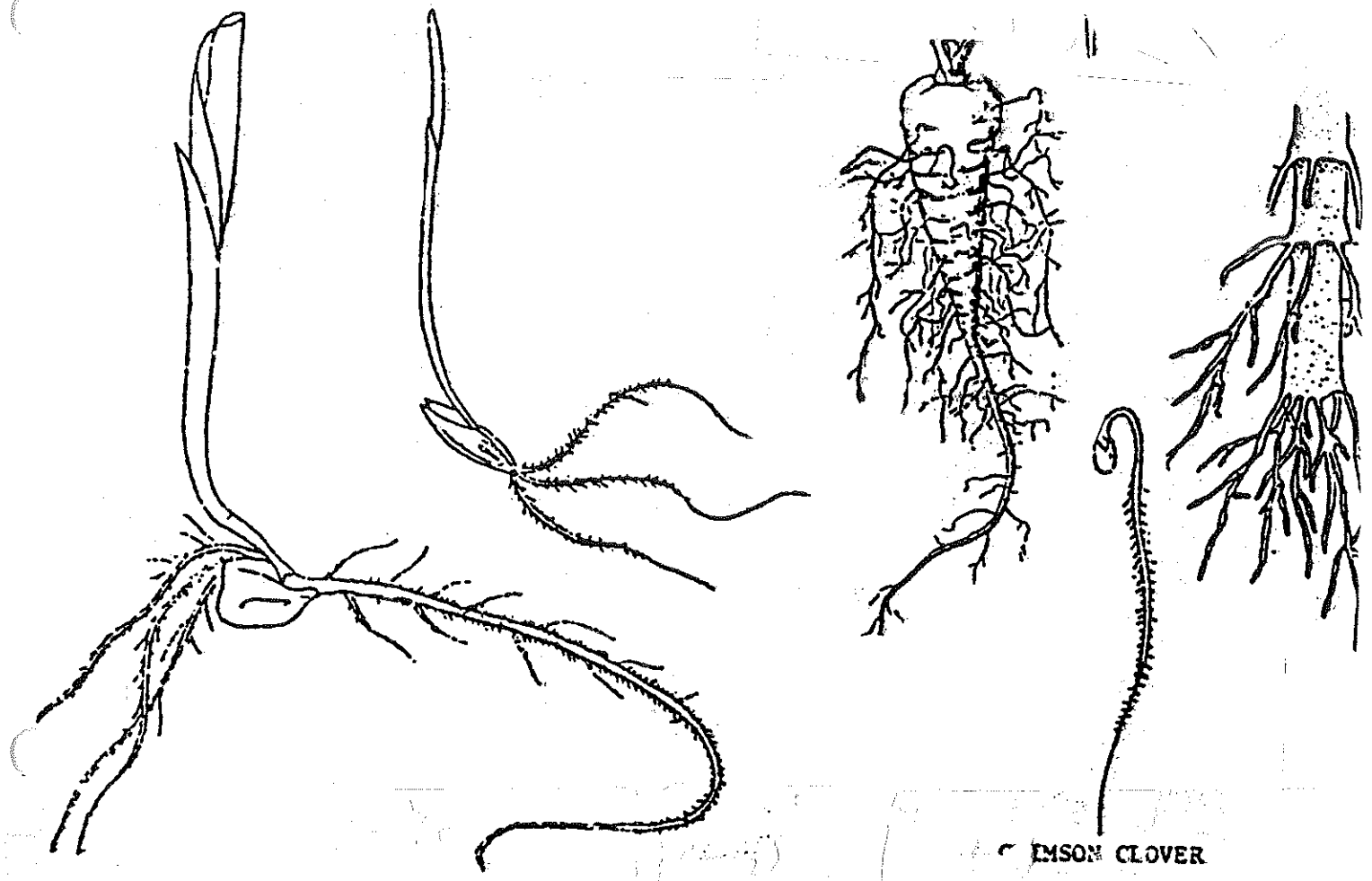
Secondary roots:

- a. Lateral: branch roots from the main or tap root.
- b. Adventitious: Arising from structures other than the root, such as: Crown roots, arising from the first node in grasses. These remain underground and form the permanent root system. Brace roots, arising from nodes above the ground in grasses.

Roots

1. List five main functions of roots.
2. What is the importance of root hairs?
3. Define and give the origin of the following kinds of roots:
 - a. Primary
 - b. Secondary
 - c. Adventitious

4. Label the kinds of roots shown:



***Roots**

Radicle: The miniature root of the embryo before emergence from the seed coat.

Primary roots:

- a. Tap: a permanent root arising from the base of the hypocotyl.
- b. Seminal: roots arising in the region of the scutellar node, usually in pairs, as in the cereals.

Secondary roots:

- a. Lateral, branch roots from the main or tap root.
- b. Adventitious, arising from structures other than the root, such as:

Crown roots, arising from the first node in grasses. These remain underground and form the permanent root system.

Brace roots, arising from nodes above the ground in grasses.

Root hairs: Minute structures, not true roots, arising from the surface of young roots, the development of which is dependent to some extent on the moisture available in the substratum.

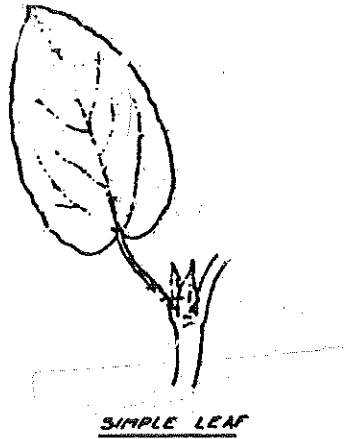
Stems

1. List three functions of stems.
2. How does the arrangement of the vascular bundles in stems differ in monocotyledons and dicotyledons?
3. Aerial stems are commonly divided into two types, herbaceous and woody. What is the main difference between them?
4. Define and give an example of the following:
 - a. Rhizome
 - b. Tuber
 - c. Corm
 - d. Bulb
5. Which of the following statements are true?
 - a. Plants having rhizomes are perennial.
 - b. As compared to a bulb, a corm is mostly stem.
 - c. The enlarged tip of a rhizome is a tuber.
 - d. Bulbs, which are flattened underground stems, are chiefly annual.
6. Complete and give an example:
 - a. An aerial stem that is bent to one side is _____.
 - b. The distinctive straw stem of a grass is a _____.
 - c. A stem that grows upright is _____.
 - d. A stem that is supported by other objects, attached by tendrils, by twisting its leaf stalks around the supporting body or by rootlets acting as holdfasts is _____.
 - e. A prostrate stem that strikes root along its lower side where it rests on the ground is _____.
 - f. A stem that remains flat on the ground is _____.

Leaves

1. What is the chief function of leaves? What is the name of this process?

2. Label:



3. Distinguish between:

- a. Simple leaf and compound leaf.
- b. Palmately compound leaf and pinnately compound leaf.

4. Are the following statements *true or false*:

- a. In leaves the interchange of gases and the evaporation of water vapor takes place through the stomata, openings formed by special cells in the epidermis.
- b. When there is not much moisture available, the guard cells in leaves open and they are said to be turgid.
- c. Cutin is a waxy substance secreted by the epidermal cells of a leaf.

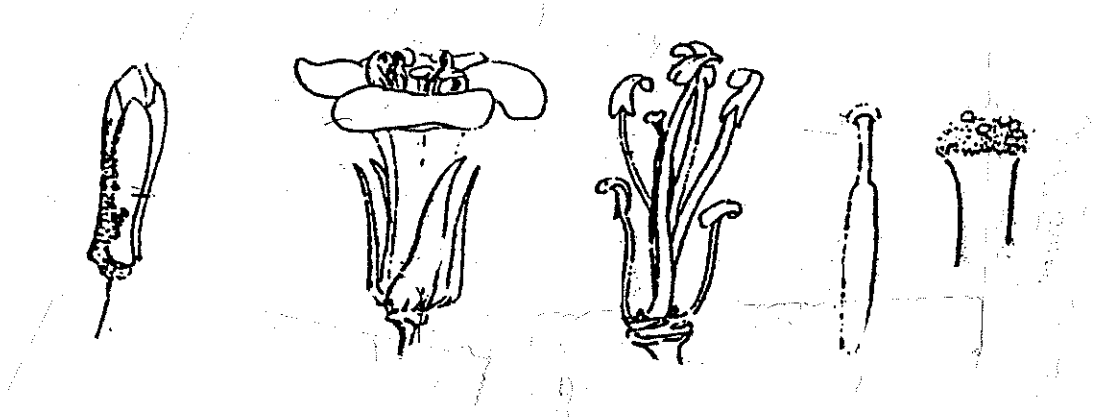
Flowers and Fruits

1. Define:

- a. Sepals:
- b. Calyx:
- c. Corolla
- d. Perianth

2. Name the female parts of a flower. What are they called collectively? The male parts?

3. Label:

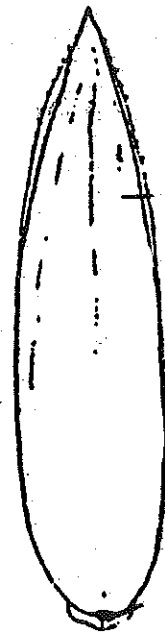


4. Distinguish between:

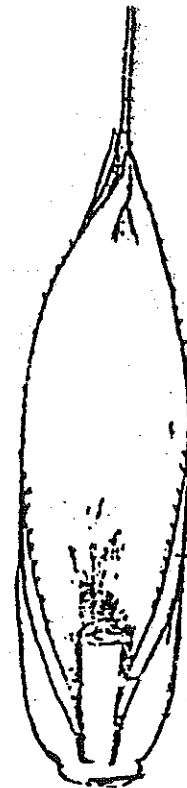
- a. Complete and incomplete flower
- b. Perfect and imperfect flower
- c. Regular and irregular flower
- d. Monopetalous and polypetalous flower

5. Outline the process of meiosis.
6. Define pollination and fertilization.
7. Describe the development of the ovule and embryo.
8. Draw the following types of inflorescences.
 - a. Solitary:
 - b. Spike:
 - c. Raceme:
 - d. Corymb:
 - e. Head:
 - f. Panicle

9. *Label:



Dorsal



Ventral

*Parts of the grass floret

Lemma and Palea: the bracts which enclose the caryopsis of a grass seed.

Rachilla: the individual stem of a grass seed.

Awn: a bristle-like appendage.

Callus: a thickened layer at the base of a floret at the point where it breaks off from the rachilla or the main axis of the inflorescence.

Suture: the line where a grass floret breaks away from its stalk.

Sinus: the space between the margins of lemma at the base of a floret on the ventral side.

Keel: an angle along the midnerve a lemma or along the two nerves of a palea.

Glumes: the pair of bracts at the base of a spikelet, rarely only one.

10. Define:

a. Fruit

b. Epicarp.

c. Pericarp

d. Mesocarp

e. Endocarp

11. Complete:

A fruit is a matured _____.

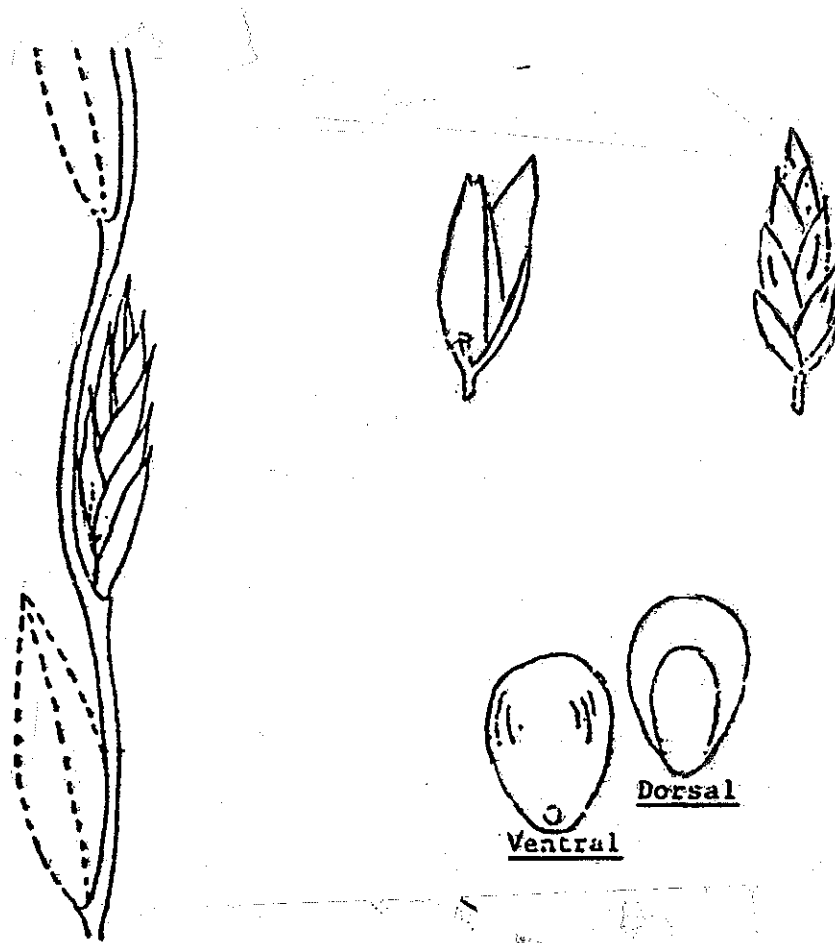
A seed is a matured: _____.

12. Complete and give an example:

- a. A one-seeded dry indehiscent fruit in which the seed is attached to the ovary wall at one point only is an _____.
- b. A seed in which the coat is fused with the ovary wall and not separable from it is a _____.
- c. A fruit in which the carpels separate at maturity, each carpel having one seed, is a _____.

13. The seed unit in Gramineae may be (a) caryopsis, (b) a fertile floret, (c) a spikelet, or (d) a spike.

Distinguish between the following:



14. Place the number of the matching definition after each of the following terms:

Ovule _____ Pappus _____ Cotyledons _____

Caryopsis _____ Micropyle _____ Rachilla _____

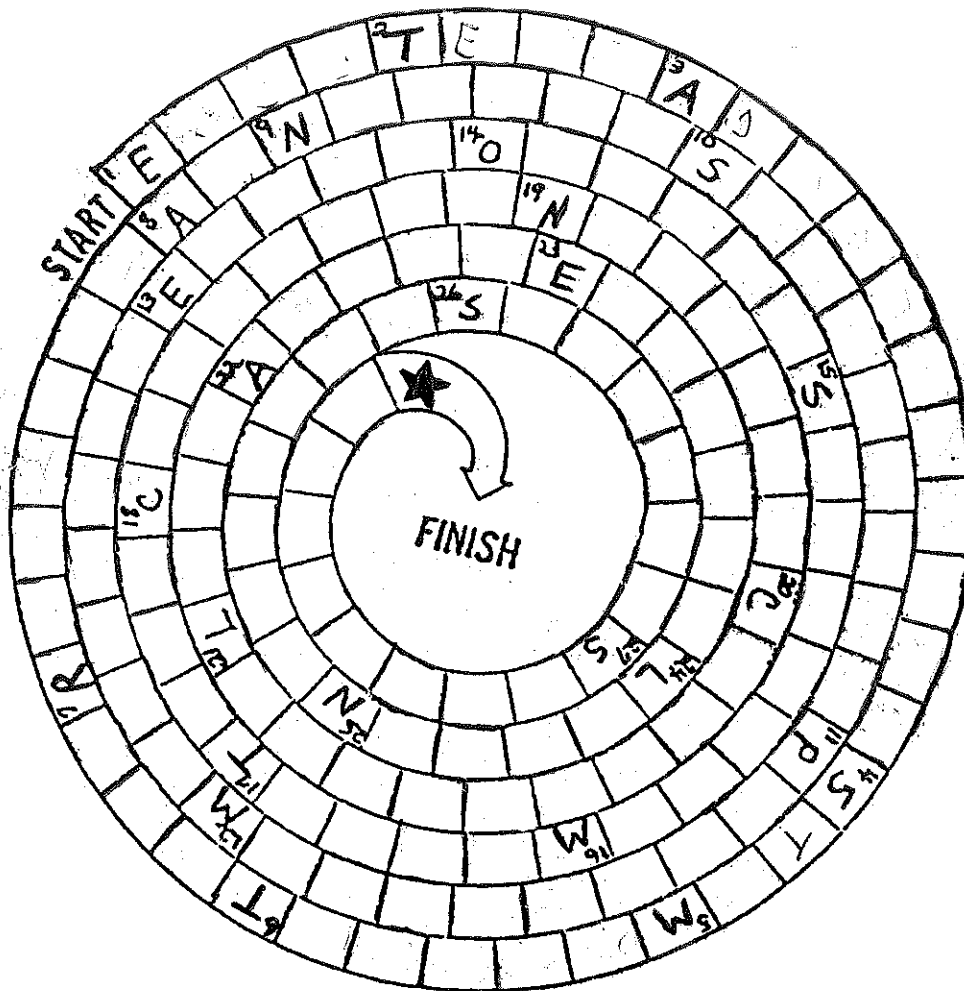
Endosperm _____ Coleoptile _____ Genus _____

Species _____

1. A cluster of several to many ripened ovaries produced by several flowers on the same inflorescence.
2. Spontaneous differences in growth rates on different sides of growing points.
3. Usually the smallest unit in classification of organisms; a group of individuals of the same ancestry, of nearly identical structure, behavior, and of relative stability of nature.
4. The minute opening in the covering of a seed which may permit the entrance of water, or assist in the emergence of the radicle.
5. The study of the form and structure of organisms.
6. A sheath enclosing the first leaf of monocotyledons.
7. An organic substance furnishing energy, or is used in the construction of protoplasm.
8. A structure which, after fertilization, develops into a seed.
9. A group of closely related species.
10. A short stalk -- that part of the plant structure to which a seed may be attached.
11. A tissue of thin walled cells developed on wound tissues.
12. Food storage tissue in grains which either before or during seed germination is digested or absorbed by the embryo.
13. Seed leaves which function primarily in the digestion, absorption and storage of food from the endosperm.
14. A dry, one seeded fruit in which the ovary wall and seed coats are fused.
15. A crown of chaff or bristles located at the top of some weeds.
16. A sheath covering which protects the tip of the young root.

17. Place a "T" in front of each of the following statements that are *true* and an "F" in front of each of the following statements that are *false*.

- _____ 1. A fruit is a ripened ovule and adherent parts.
- _____ 2. Seeds may be monocotyledons or dicotyledons.
- _____ 3. A kernel of corn is a good example of a dicotyledon.
- _____ 4. A grass seed is a fruit but is called a caryopsis.
- _____ 5. A pea or leguminous flower is a regular flower.
- _____ 6. A rhizome is an underground stem.
- _____ 7. Chlorophyll, a green pigment in leaves, is active in photosynthesis.



Ring Around the Seed Laboratory

Botanical terms used by Seed Analysts

You will have fun solving this puzzle based on botany. The last letter of each word is the first letter of the next word. These definitions may be found in the glossary of Agriculture Handbook No. 30 and the Yearbook of Agriculture, 1961.

1. A substance produced by a fungus which takes the place of the grain in grasses.
2. Hard outer seed coat.
3. Roots that arise from any structure other than a root.
4. The part of the plant that bears leaves, flowers, and tree buds.
5. A short synonym which refers to plants that have single seed leaves and no distinct bark and wood layers.
6. The enlarged tip of a rhizome filled with stored reserves of food.
7. The axis of a grass spikelet, the small stem on which the flower or floret is borne.
8. A slender bristle such as the "beards" of rye or wheat.
9. The part of the plant cell bearing the chromosomes, carriers of hereditary units.

10. Dry, two-seeded fruit of the carrot family.
11. The essential, complex, living substance of cells upon which all of the vital functions of nutrition, secretion, growth and reproduction depend.
12. The pore or opening through which the pollen tube enters the embryo sac during the fertilization process.
13. The rudimentary plant within the seed.
14. The diffusion of a liquid through a differentially permeable membrane which allows certain substances to pass through it, but which restricts or prevents the passage of other substances.
15. The cotyledon of an embryo of a grass; a food absorbing structure.
16. A plant or animal that differs from its normal or parent strain by virtue of an altered genetic characteristic.
17. Acting or likely to act as a poison.
18. Seed leaves of the embryo. Usually they are thickened for storage of reserve food. They may serve as true foliage leaves.
19. Death of plant cells, especially when resulting in the tissue becoming dark in color.
20. The green coloring matter of plants.
21. The outer bract of the flower of grasses, sometimes referred to as the flowering glume.
22. A small, dry, hard, one-chambered, one-seeded indehiscent fruit, as in buckwheat, commonly referred to as a seed.
23. That portion of an embryo or seedling above cotyledons; plumule.
24. A wound.
25. Threadlike roundworms that live in soil and water.
26. Rough to the touch, covered with short hairs.
27. Germination medium.

****Answers****

The following are the answers to the questions on pages 1 & 2

1. Ergot
2. Testa
3. Adventitious
4. Stem
5. Monocot
6. Tuber
7. Rachilla
8. Awn
9. Nucleus
10. Schizocarp
11. Protoplasm
12. Micropyle
13. Embryo
14. Osmosis
15. Scutellum
16. Mutant
17. Toxic
18. Cotyledon
19. Necrotic
20. Chlorophyll
21. Lemma
22. Achene
23. Epicotyl
24. Lesion
25. Nematodes
26. Scabrous
27. Substrate

Special Testing Procedures

Define and give the use of the following testing procedures:

A. Vigor Test

1. Cold Test: ("Cold Testing Seed Corn" by Paul E. Hoppe. Bulletin 507, January 1955. Agri. Experiment Station, University of Wisconsin, Madison, Wisconsin).
2. Primary root length. (AOSA Proceedings - 1965. Pages 92-96 and 131-139).
3. G.A.D.A.: (AOSA Proceedings - 1965. Pages 92-96 and 131-139).
4. Tetrazolium, (AOSA "Tetrazolium Testing Handbook")

B. Varietal Test (USDA Handbook No. 30 - Pages 178 - 182).

1. Phenol test for wheat. (No. 28 Handbook on Seed Testing, AOSA. A Standardized Phenol Method for Testing Wheat Seed for Varietal Purity. William E. Walls - June 1965).

C. Bioassay Test for Detection of Treated Seeds. (Crosier and Kulik; Handbook on Seed Testing, AOSA "The laboratory detection of fungicidal seed treatments, 1964").