



# KCIA Field Inspector's Handbook



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## **FORWARD**

**The purpose of this manual is to orient inspectors with basic knowledge important to conducting field audits for KCIA and to provide guidelines for performance in the field. It also contains a brief history of KCIA and information on the Plant Variety Protection Act (PVP) so that inspectors have an understanding of the organization for which they work and of some of the laws governing seed production and sales.**

**The general guidelines contained within are applicable to any crop inspected. However, since wheat is crop the inspector will most likely audit for KCIA, wheat-specific information has been included in preference to other crops such as soybeans. In the event that you have the opportunity to inspect a crop other than wheat, instruction specific to that crop will be provided prior to conducting the audit. Otherwise, procedures such as plant counts and completing the inspection report will be similar for all crops.**

**This manual is a supplement to, and not a replacement for, the Certification Standards and the Inspector Guidelines. It is these two documents that will govern your decision making in the field. This manual will help you gather information in order to arrive at the decision making point.**

# Kansas Crop Improvement Association

## MISSION STATEMENT

The Kansas Crop Improvement Association creates the opportunity for our members to participate in integrity based quality assurance programs that provide superior seed and plant products. We utilize research, education, certification and uniform standards that result in a safe, stable, secure seedstock supply.

## Background

In 1902, the Kansas Seed Corn Breeders Association was formed to improve the kinds of corn in the state through cooperation with Kansas State University (then Bluemont College) and the Kansas Experiment Stations. However, it wasn't too long before the interest of the group spread to other crops, particularly wheat.

In 1914, the name was changed to the Kansas Crop Improvement Association (KCIA) and the Constitution adopted in 1915. fields were first inspected for varietal purity in 1919 and the term "Certified" was used in 1922. KCIA was incorporated in 1936 in order to protect its members from legal action that might be taken against them because of acts of the Association.

Up until 1937 KCIA had no legal right to carry on the activities of certification or to keep any organization from assuming this right. It was in this year that the state legislature passed the Kansas Certification Law, which authorized Kansas State University to appoint an agency to carry out the necessary functions of certification in the state of Kansas. Each year KCIA reports it's activities and the university has re-appointed the Association as the official state seed certifying agency. In 1998, the Association adopted significant changes in it By-Laws and filed new Article of Incorporation with the State of Kansas that re-defined its purpose.

The Association is a private, non-profit organization totally supported by its members through dues and fees. It has 501(c)5 status under the IRS code. The Association receives seed certification authority through a memorandum of understanding with KSU. Because of continual growth and university cut-backs, the Association caused its office to be constructed on university land in 1986. The KCIA has a continuing lease for use of the facility and the university pays for some utilities.

### *Code of Ethics*

- 1. Recognize my individual responsibility for increasing and maintaining the genetic purity of seed for the public good.*
- 2. Properly represent all products and services.*
- 3. Comply with all applicable federal and state laws.*
- 4. Comply with all KCIA standards.*
- 5. Use honest business practices.*
- 6. Consider my individual part in the local, state, national, and international seed industry.*
- 7. Recognize my responsibility in reflecting on the image of fellow seedsmen.*
- 8. Maintain adequate equipment and study the operating manuals.*
- 9. Keep up to date on all new procedures, technology and other developments.*
- 10. Resolve complaints in a prompt, business-like fashion.*

# SEED LAWS

## STATE and FEDERAL

State and federal seed laws are basically “truth in labeling” laws. On almost all cases, regulatory activities are guided by state laws. Therefore, it behooves all labelers of seed to be aware of seed laws in all states in which their product may be sold. All Plant Variety Protection labeling provisions are included in the Kansas Seed Law.

Seed laws detail the analysis and labeling requirements for all seed trade in that jurisdiction, whether state or federal. This information provides a standard by which all seed buying and selling may be conducted. Seed laws regulate activities.

The first seed laws in Kansas (1925) required the testing and labeling of every seed sale - no exceptions. Later, an exemption for “growers of agricultural seed” was devised. This “farmer exemption” was to allow for disposition of excess seed at the end of the planting season or to provide a neighbor with some grain to finish his planting. Gross abuse of this exemption by a few has served to limit the desired freedom of many. A very limited exemption from testing and labeling remains in the Kansas Seed Law, but does not apply to protected varieties nor to certified seed growers or seed dealers.

All prudent seed sellers and buyers are advised to utilize the testing and labeling provisions of the seed laws in every instance. The time, confusion and expense associated with resolving disputes arising from misunderstandings about undocumented transactions is very high.

The KCIA office maintains a library of state and federal seed laws and regulations. Please call or write if you have questions about seed laws, testing, labeling, etc.

### AN OVERVIEW OF THE PLANT VARIETY PROTECTION ACT AMENDMENTS OF 1994

Signed into Law, October 6, 1994  
Effective Date: April 3, 1995

Meets all of the provisions of the 1991 International Convention for the Protection of New Varieties of Plants (UPOV)

Outline compiled by Jim Swanson, North Dakota State Seed Department, reprinted by permission, April, 1995

### MAJOR PROVISIONS IN PVP ACT AMENDMENTS

- Changes some definitions and terminology.
- Establishes a category of "Essentially Derived Varieties."
- Establishes date of filing for protection as basis for determining eligibility for protection.
- Requires that variety name be used when selling protected varieties after protection has expired.
- Extends protection to first generation hybrids.
- Increases length of protection from 18 to 20 years (25 years for trees & vines).
- Expands scope of protection to include tuber propagated species.
- Allows owner to waive their right to the specified number of generations allowed to compensate for unforeseen production problems or natural disaster.
- Certificate of protection under the amended law applies only to varieties applied for or receiving protection after the effective date of the amendments.
- During transitional period, allows Breeders to withdraw varieties in "Applied for" status to withdraw and reapply for protection under the amended law. (Restrictions may apply.)
- Retains "Saved Seed" provision of current law.
- **Prohibits unauthorized sale of protected varieties by producers to other producers.**
- Includes knowingly conditioning seed for unauthorized propagation as an infringement of the Act.
- Includes "Stocking" the variety for the purpose of propagation as an infringement of the Act.
- Extends protection to harvested material produced from illegally acquired seed.
- Eliminates any gender based language in current law.

**How will passage of these Amendments serve Breeders and Producers?**

1. It will encourage development of new varieties by ensuring an adequate return on investment to breeders and developers.
2. It will encourage an international market for seed by ensuring developers protection in other countries who are members of UPOV, giving American producers access to varieties developed worldwide.
3. It will provide producers with a continued stable supply of high quality varieties at a reasonable price.

## **PROVISIONS THAT AFFECT PRODUCERS**

- Retains "Saved Seed" provision
- Producers who purchase a variety with the authority of the owner would have the right to replant the progeny of that seed on their own farm for an unlimited period of time.
- Retains the provision that allows the producer to sell crops grown from seed of a protected variety for non-reproductive purposes.
- Removes the right to sell any of the "Saved Seed" to another producer for the purposes of propagation.
- Prohibits a buyer of "grain" of a protected variety for use for non-reproductive purposes to convert that grain for productive purposes. Notice must be given to the buyer that the variety is protected.
- Prohibits a conditioner from knowingly conditioning seed of a protected variety for purposes of propagation except that which is allowed under the "Saved Seed" provision. (Ex. #1)
- Prohibits 'Stocking' seed of a protected variety for the purposes of propagation. Extends protection to harvested material if produced from "unauthorized seed". (Ex. #2)

## **NOTICE REQUIRED**

Requires that proper notice must be given that a variety is protected.

1. For varieties in applied for status the words "unauthorized propagation prohibited PVPA - 1994," or "unauthorized seed multiplication prohibited - PVPA - 1994."
2. For varieties having received a Certificate of Plant Variety Protection the notice should read "unauthorized propagation prohibited - US protected variety - PVPA - 1994" or 'unauthorized seed multiplication prohibited - US protected variety - PVPA - 1994'.

Protection under the amendments of the Act is limited to varieties that are "new" in the sense that the variety has not been sold for the purpose of exploitation more than one year prior to the date of filing, (interpreted to mean readily available to the public or no longer controlled by the owner).

### **EXAMPLE #1**

A producer brings 5000 bushel of a protected variety to a conditioner for conditioning. The conditioner has knowledge that the producer farms only 1000 acres. There is likely an excess of 3000 bushel being conditioned that the producer cannot use on his own farm. What would be the extent of the conditioners liability? The Act provides that a violator can be liable for up to triple the damages plus costs. Are the damages limited to a reasonable royalty times three? Could the damages be determined to be based on the potential lost sale for the owner?

### **EXAMPLE #2**

A producer buys enough 'brown bag' seed to plant 100 acres. The producer produces 4000 bushel of "grain" from the planted 'brown bag' seed. The owner of the variety could recover damages based on the 4000 harvested bushels. Suppose the grower used some of the 4000 bushels to plant 1000 acres the succeeding year and produced 40,000 bushels of harvested material. Is the owner of the variety entitled to damages based on 40,000 bushels? The Act provides that the owner of the variety must file a complaint within one year of knowledge of a suspected violation. The Act allows the owner up to six years to file a complaint.

## FIELD INSPECTION OVERVIEW

Field inspection serves a two-fold function in the production of certified and quality assured seed. One function deals with public relations and education of the seed grower, while the second function provides a mechanism for field acceptance or rejection under the certification standards or quality assurance (QA) guidelines.

Much of the success of a certification or QA program depends upon the inspector conducting the field inspection. The inspector is the eyes of the organization. Though it may seem like a regulatory activity, field inspection is actually providing a service to the applicant. Inspection is the mechanism whereby the applicant shows KCIA that he/she has followed set standards and procedures in good faith and that the field is worthy of certification.

It should always be kept in mind that the Kansas Crop Improvement Association is not a regulatory organization, but one of service. The applicant agreed, at the time he/she made application for certification, to pay the Kansas Crop Improvement Association for a service to be rendered based upon certain regulations. Should the applicant meet the established standards, then the Association agrees to issue a certificate which signifies the seed in question has met those standards for certification. Your job as inspector is to make a report to the Association and to the applicant as to the condition of the field at the time of inspection.

As an inspector, you should have a conviction as to the advantages of certified seed and quality assurance programs, and be able to point out these advantages should the applicant become hesitant about the advisability of making a small correction.

Remember, you represent Kansas Crop Improvement Association and need to approach the seed producer with a positive attitude.

## INSPECTION PROCEDURES

### Inspector's Role

1. The inspector's role is vital. His/her contact with the applicant is the contact that establishes the eligibility of the crop. It is for this reason that the inspector's judgment must be sound. A field presented to KCIA by the applicant as being compliant with certification standards requires inspection to verify that the field is indeed compliant. Without such on-site verification, KCIA would have no legitimate basis on which to approve certification. The inspector therefore has the very important task of fairly and accurately describing that field in a report to KCIA.
2. The field inspector is usually the principal contact between the certification agency and the certified seed grower. Professionalism, competence, and confidence are all-important attributes of an inspector and convey to the applicant an assurance that his/her field will receive a fair and accurate assessment.
3. An inspector must thoroughly understand the field standards and be capable of appropriately applying those standards in the field. The inspector should show initiative in improving his/her general knowledge beyond the basics taught at training.
4. The inspector must be unbiased and adhere to the field standards and guidelines as directed by KCIA. To do otherwise is to damage the expectation of fair and equal treatment for all of our applicants. Stick to the standards and guidelines even if you may find fault in them. There are procedures whereby members can work to change standards if thought unfair or unreasonable. It is not the place of the inspector to make that decision.

### Planning the Inspection

1. When given an assignment, contact the applicant immediately. Introduce yourself as the one who will be conducting the field inspection. Make sure to leave your name and contact information so that the applicant can reach you if need be. Explain what stage of maturity the field must be at in order to conduct the inspection. Ask to for notification seven to ten days prior to harvest so inspection does not conflict with harvest.
2. **Plan inspection visits to keep mileage at a minimum and to conserve time.** The *myfields* program has a mapping function that will assist you in mapping out your travel route for the next day's work. Plan your daily travels to minimize backtracking and wasted miles. GPS can assist your navigation to the fields.

3. **Go prepared to visit fields under cold or wet conditions, if necessary.** Likewise, never go to the field without having in your vehicle, your copy of the standards, guidelines, and any reference materials (weed id, etc.) that may be needed. These can easily be downloaded to your assigned table.

#### Interacting with the Grower

1. Politely avoid extended conversation that although pleasant, erodes time efficiency and delays completion of the inspection. Everyone understands busy schedules. Saying something to the effect of “Well, I guess I’d better get going, I have several more fields to look at and I don’t want to rush through them” lets the applicant know that while visiting might be preferred, harvest is coming on and inspections must be made.
2. An inspector should feel capable and free to discuss certification with the grower. Be courteous and helpful but remember that an inspector cannot give advice on how to overcome a problem that may be found, due to conflict of interest concerns. The inspector can and should clarify what is required by a specific standard. Refer special questions of policy to the Association office.
3. The applicant may wish to accompany the inspector through the field. This is acceptable and the inspector should offer the opportunity. Bear in mind that the inspector must not be distracted and must not allow the applicant to influence the inspection. Set the pace and work efficiently. Avoid giving the applicant the impression that the inspection is hurried or haphazard.

#### Conducting the inspection (see Inspector Guidelines document for specific information).

Inspection requires an understanding of:

1. Varietal characteristics of the crop and cultivars. With experience, an inspector grows to recognize cultivars and characteristics of cultivars inspected and can draw upon this experience to aid in future inspections of that cultivar. An inspector, for instance, may recognize a different looking plant as being in all fields of a given cultivar and indeed, that is described by the breeder of that cultivar as a common and allowable variant.
2. Isolation and separation of fields as required by specific crop standards.
3. Diseases that might be commonly encountered in a specific crop, especially those that may be prohibited or restricted by certification or quality assurance standards.
4. Noxious and objectionable weeds listed in the crop-specific standards. It is imperative that the inspector be able to distinguish between noxious weeds that lead to field rejection, and objectionable weeds that usually will not. Failure to obtain a workable knowledge of the weeds listed in the crop standards can lead to wrongly accepting or rejecting the field.
5. Off-types and variants. The inspector must, given an adequate varietal description, be able to distinguish an off-type (that different looking crop plant that represents a different cultivar) from a variant (that different looking crop plant that has been described as a part of the cultivar). For example, a taller, red-chaffed wheat plant in a field of white-chaffed wheat is an off-type if not included in the breeder’s description of the cultivar and is a variant if described as being part of the cultivar and is present in a frequency no greater than that included in the description. A variant will become an off-type if it is present in higher frequency than the cultivar description allows.
6. Abnormalities that may be due to nutritional deficiencies, temperature variation and moisture stress effects on the crops inspected. Is that area of shorter plants due to a different type plant or due to an environmental factor such as heavy weed growth or disease? Often, man-made errors such as incorrect cultivar, or planter contamination, will be somewhat linear in pattern while environmental issues show up in a random or roughly circular pattern. Often, allowable variants may respond differently from the cultivar and be expressed as taller or shorter in different areas of the field.
7. Sampling and counting methods. Plant counts are important and must be recorded. The inspector should understand how to make random counts of plants or seed heads in the field. There is a need to look not only for taller, obvious off-types but also those that may be shorter and hidden in the canopy. The inspector should have a measuring device or be able to pace off a given distance with reasonable accuracy and consistency.

## Completing the field inspection report

1. The field inspection report is the basis for issuing tags, settling complaints, etc. An accurate, complete, report is essential.
2. Your *myfields* account will contain your field assignments as well as field descriptions and tools for navigation. You will also file your report in *myfields*. However, you will conduct the actual inspection using a paper form to record findings which you will then file in *myfields*. This is to keep the inspector focused during the inspection rather than fumbling with a tablet.
3. “Remarks” – Provide statements here that are felt necessary to clarify findings. For example, such things as droughty conditions, drowned out areas, lodging, insect damage, and others can be mentioned here and drawn on the map to explain a low yield estimate. If a field is rejected, further details may be listed here. Be helpful to the applicant. Be clear and concise.
4. Keep all reports in a briefcase or folder and enter them into *myfields* as soon as possible.
5. Don’t attempt to answer applicant questions about which you are uncertain, but try to secure the right answer, or give him/her the right source of information, or the name of a person to contact.
6. Make reports complete. If there is something that should be noted, write it on the report. You may commend growers who have done a good job by noting this on the report. Remember to put on the field inspection report what you see in the field, but be sure you see what you report.
7. Make a separate report for each inspection. If a re-inspection is needed, and if *myfields* allows the creation of a reinspection form, file your report with that. Otherwise, use a paper reinspection form. Each inspection requires a separate report. Remember to record miles and hours for a reinspection.
8. Make notes of your questions so that you can take them up with the KCIA staff, and don’t consider that any question is too minor to be considered.
9. Avoid careless remarks to growers or other parties about work that is being done. Avoid making comparisons of one applicant with another.
10. Try to keep the office informed at all times as to where you may be contacted. Whenever possible, make a copy of your schedule and send it to the office.
11. Make counts on all fields and record the counts on the inspection form. Randomly select an area for counting by throwing your hat in the field or other method. All counts must be made at random locations. Make at least five counts in different areas of the field. The sequential sampling chart must be used to reject a field.
12. Prohibited noxious weeds are not permitted in certified fields. However, if an applicant has the area of infestation isolated in some manner, such as mowing, staking, etc., it is possible to meet certification requirements. Spraying is acceptable provided that all noxious weeds are completely killed.
13. All applicants receive letters of instruction well in advance of your visit, and the fields should be ready for inspection. Therefore, fields must be recommended for approval or rejection by the inspector on the basis of their condition at the time of inspection, not on what the applicant states is intended. There are, of course, situations in which the inspector will need to use his/her own discretion as to whether or not the field should be approved or rejected.

## Reporting Inspection Results to the Applicant

1. Make sure the applicant understands why a field has been rejected.
2. An inspector can explain the standards but can not give advice on correcting a problem. For example, if a field is rejected for uncontrolled field bindweed, it would be appropriate for the inspector to state that noxious weeds can be controlled by staking, spraying, mowing, etc. but could not state “if you place a stake there and there, I’ll pass the field”.
3. Get the applicant to realize his/her personal responsibility in a pure seed program.

4. Where objectionable weeds that can be eliminated in seed cleaning are present in a field, warn the applicant that special attention must be given to cleaning.
5. Emphasize the necessity for completing all certification requirements before offering seed for retail sale, especially for “Protected” varieties.
6. Explain the requirement for any custom cleaned seed to be cleaned through an Approved Certified Seed Conditioner. This is especially important for new applicants.

#### Returning Field Reports

At the end of every few days of inspection, mail the completed originals of field inspection reports and ID’s to KCIA. **Contact the applicant immediately upon completion of his/her fields, especially if there is a problem with a field. Return office copies as soon as possible.** If field reports are not returned to KCIA in a timely manner, office staff is unable to answer applicant questions that may arise.

#### Reporting Irregularities

1. Make special note of any irregularities so that the Association office may render the necessary specialized services.
2. Don’t accumulate a mass of loose ends. See that each applicant is properly represented. Special notes may be made on the back of the inspection report or on attached sheets.

#### **HINTS AND SUGGESTIONS FOR INSPECTORS**

2. Be prepared to work in almost any kind of weather but do not place yourself at risk. Do not enter a field if lightning or thunder is seen or heard. Immediately leave a field if weather threatens. Adopt a “safety first” attitude and use common sense. Avoid heat exhaustion and drink plenty of liquids.
3. Make thorough inspections of the field to confidently recommend approval or disapproval. Work as efficiently as possible, yet take time to check the field closely and give essential information to the producer. Work fast, but do not act like you are in a hurry. Unusual cases may be referred to the office, but these must be held to a minimum, and reports on them should be very detailed.
4. Look the field over as you approach it by car and note any areas that you’ll want to specifically check when in the field. Such areas would be those where the stand is thin, lodged, weedy, or where just the “look” of the field is different. Looking over the field from a high point is a good way to locate drill strips containing different varieties.
5. Since you have to end up at your car anyway, walk half the field up and half the field back to your car. On a large field you may have to travel up and down the field more than one time to adequately inspect the field.
6. A very rough measure of your efficiency when inspecting a field is to use one minute per acre as a guide. An 80 acre field will take roughly 70 to 90 minutes. If you are going faster than one minute per acre, you must ask yourself if you are adequately covering the field. If you are taking longer than is reasonable, decide if you are taking too long to reach decisions, or maybe not walking fast enough, or even covering too much of the field. Ultimately, you must satisfy yourself that you have an accurate picture of what the field condition is. Some fields will take longer than others depending on terrain and crop stand.
7. The goal of the inspector when walking the field is to gather information so that when the inspection report is filled out a decision on acceptance or rejection of the field can be made. The inspector only sees a relatively small part of the field when all is said and done. Therefore, if you only see one small bindweed plant, you can’t be sure that is the only one out there, likely there are more. So, we walk the field in an efficient manner that gives us good representation of the field and accept and reject on the information we find in the field, not on what else may or may not be in the field that we missed.
8. Enter your inspection reports as they are completed. Do not put off entering your reports. KCIA must be kept up to date on field status. Report immediately, any fields that are rejected or that have special conditions needing immediate action.

## SAFETY

Field inspection is a rewarding way to combine outdoor activity with purposeful achievement. As with anything, however, being aware of potential situations that can occur and avoiding hazardous situations will keep you safe and add to your enjoyment of your work. Never place yourself in danger to complete a field inspection. Rather, postpone the inspection until it can be done safely, or contact KCIA if you need extra help.

**Weather:** Keep an eye on the weather. If thunder is heard, or lightning seen, do not enter the field. Lightning has been known to strike victims from as far as 12 miles away. Of course, thunder indicates lightning is present. If a storm is approaching, leave the field immediately. Do not reenter the field until lightning is no longer seen, and thunder has not been heard for 30 minutes. During times of tornado watches or warnings, have a plan in the back of your mind what you would do if one suddenly appeared. Also, in times of heavy rains, be aware of flash flood areas, especially if driving after dark.

**Heat Exhaustion:** Perhaps a greater risk than violent weather is heat exhaustion. Especially on hot days, be sure to drink plenty of water to avoid dehydration. Dress appropriately to protect yourself from the sun. If you begin to feel nauseous, headachy, or begin to cramp up in the legs or stomach, and/or sweating profusely, leave the field immediately and find some shade to cool down. Drink liquids. Call someone if you need to. In this case a sports drink type electrolyte replenisher is good. Failure to heed the warning signs of heat exhaustion can lead to **heat stroke**, a much more serious condition from which you may not recover. With heat stroke, sweating ceases and body temperatures can get dangerously high.

Dress so that the body is covered, i.e. long-sleeved shirts, and wear a ventilated hat. Pace yourself and make sure that plenty of liquid is taken.

**Chemicals:** After chemical application is made to a field, there is a period of time when casual entry into that field is forbidden. This is the **Restricted Entry Interval (REI)** and its purpose is to prevent exposure to the chemical. The REI is found on the chemical label.

KCIA inspectors are **not allowed to enter a field within 72 hours** of when a chemical application is made. The inspector must be sure of the entry status of the field prior to entering. At first contact with the applicant, the inspector should leave contact phone information so that the applicant may contact the inspector. During this initial conversation the inspector should inquire about plans to spray any of fields to be inspected as well as any adjacent fields. The applicant should be told to call if any chemical applications are made within 72 hours of the inspector's visit.

Having been told that there is no REI in effect for a field, the inspector should still be aware of possible exposure. If chemical smell can be detected in the field, call to reconfirm the field status or postpone inspection for a day. If it is breezy and there is a chemical applicator spraying downwind such that drift is a potential hazard, leave the field. If you are in a field and a crop duster begins circling, make sure the pilot can see you. He/she may be preparing to spray the field.

Symptoms of chemical exposure can include sleepiness, headache, dizziness, sweating, blurred vision, nausea, diarrhea, rash, or pinpoint pupils. Some of these symptoms can also indicate heat exhaustion or other medical conditions. It is important to stay aware of your surroundings and assess your health while in the field.

If you think you have been exposed to chemical, wash with soap and water and change clothes immediately. Inform KCIA of the applicant's failure to properly notify the inspector.

**Equipment:** Do not conduct a field inspection in a field in which farm equipment is operating (i.e. combining) unless you feel comfortable that you are safe and the operator can see you. The inspector has the prerogative of requiring that the machinery sit idle while the inspection is completed, or refusing to complete the inspection until it has been stopped.

Always be aware of the physical environment around you. Leave the field if a storm approaches to avoid lightning strikes. Watch for holes, ditches, wild animals, pets that bite. Drink plenty of non-alcoholic liquids. Guard against heat exhaustion/heat stroke. Be aware of chemical applications being made in adjacent fields.

**BE ALERT!!!!**

## THE KANSAS CROP IMPROVEMENT ASSOCIATION

### Preparing wheat, oats and barley seed fields for Certification

*( this is included for inspectors to understand that members are forewarned to prepare fields)*

Every detail of steps in a seed production operation must be constantly and closely monitored in order to produce genetically and mechanically pure seed that will meet the minimum requirements for certification.

Careful supervision must be given from the time of field history determination through planting, roguing, harvesting, conditioning, and final sale of the seed. In this way, contamination can be held to a minimum and high quality can be maintained.

### Rogues and Roguing

A rogue is any plant, which is undesirable. It can be a weed, a diseased plant, another crop, another variety, or an off-type of the same variety. It should be removed, isolated, or controlled by some method that will insure the genetic and mechanical purity of the seed lot.

Roguing is the only way to maintain or improve varietal purity. This is best accomplished by walking through a field, taking strips 10 to 12 feet wide, pulling and removing every off-type plant found. Each field should be rogued several times, preferably during different states of growth and at different times of the day and walking in different directions each time.

### When the Inspector Inspects

The inspector will arrive after the crop begins to ripen, but before harvest. (Fields cannot be inspected or certified after harvest.) He/she will be looking for:

1. Isolation - the field shall be isolated from any other wheat variety and/or from the same variety of the same crop that does not meet the varietal purity and seed history requirements by at least these distances:

Foundation . . . . . 50.0 feet  
Registered . . . . . 30.0 feet  
Certified . . . . . 20.0 feet

*Mowing, plowing, disking, or swathing these strips after flowering and prior to inspection will provide adequate isolation. Staking an equal area to be harvested for grain rather than seed will also provide adequate isolation. Additionally, all fields must be separated from any other field by some distinct line of demarcation. Wheat must be separated from barley or rye by at least six feet.*

2. Varietal purity - a **wheat** field must not contain more than 0.04% (1 head in 2,500) of other varieties for certified seed production, 0.02% (1 head in 5,000) for registered, or 0.01% (1 head in 10,000) for foundation. Please **consult the crop-specific standards** for crops other than wheat.
3. Weeds - There are three situations in which a field could be rejected for weeds:

- Uncontrolled areas of Prohibited weeds (Canada thistle, field bindweed, hoary cress, bur ragweed, leafy spurge, musk thistle, quackgrass, Russian knapweed, Perennial sorghum)
- Presence of objectionable weeds to the degree that they cannot be removed with available conditioning equipment. (Objectionable weeds are listed in specific crop standards.)
- Excessive amounts of common weeds, which may make the field unsightly or give difficulty during conditioning.

*Any field described in the above situations may be “Passed/CSI” if properly controlled by isolating with stakes, mowed, plowed, disked, or chemically sprayed in the problem areas. These fields have “Passed” the field inspection standards, but will now be subject to a “Cleaned Seed Inspection” before final certification is determined.*

*The presence of Jointed Goatgrass in any amount in the field, will require that the seed be cleaned using a length grader or gravity table in addition to the air-screen cleaner.*

4. Other Crops - can be a cause for rejection if present in the field at the time of inspection. Tolerances are as follows:
  - **Wheat:** (1) 1 head in 10,000 (0.01%) for Foundation and Registered, 2 in 10,000 (0.02%) Certified, of oats or barley.  
(2) If any rye or triticale is found in the production field.
  - **Oats:** (1) 1 head in 10,000 (0.01%) for Foundation and Registered, 2 in 10,000 (0.02%) Certified, of wheat, rye or barley.
  - **Barley:** (1) 1 head in 10,000 (0.01%) for Foundation and Registered, 2 in 10,000 (0.02%) Certified, of oats, rye or wheat
5. Disease - Those spread by seed-borne organisms are of concern during field inspection. Maximum tolerances are listed in specific standards. Those considered in certification are:
  - In wheat - - bunt (stinking smut) and loose smut.
  - In oats - - smut
  - In barley - - covered smut and loose smut

*Plans should be made to use an appropriate seed treatment if any of the above diseases are found. Fields or seed containing any disease prohibited or quarantined by the Kansas Department of Agriculture or the U.S. Department of Agriculture will not be eligible for certification.*

### **Next Year’s Seed**

A part of a seed production field that is producing foundation or registered class seed, that is marked off and given extra attention is a good way to improve your seed quality and reduce roging needs next year. This area should be harvested and handled separately for planting your fields next season.

Careful attention to a small area can pay off many-fold by reducing roging requirements and improving seed purity.

Remember that new varieties are produced under the limited generation system. Foundation seed can produce registered seed that can produce certified seed. The certified seed cannot be re-certified.

Experienced growers are increasingly planting foundation seed each year. They report reduced roguing requirements and the satisfaction of offering their customers the best seed possible.

Call KCIA if there are any questions. 785-532-6118.

# ROGUES AND ROGUING

## Canadian Seed Grower's Association

The Canadian Seed Growers' Association is recognized officially under federal seed legislation as Canada's seed pedigreering agency. In Canada the pedigreed seed grower through his/her Association assumes responsibilities that in other countries would normally belong to government agencies. Those seed growers designated as "Select Seed Growers" produce and maintain a unique generation of pedigreed seed, "Select Seed". Breeder seed is multiplied by Select growers as Select seed in order to have sufficient stocks to maintain needs for the variety. The Select seed grower multiplies and processes the plant breeder's material, essentially performing the function that is normally the responsibility of the plant breeder in other countries. The Association and its members thus bear the responsibility of presenting each new crop variety to the farmer in the form of pedigreed seed and the responsibility of maintaining the genetic purity of the variety through all the pedigreed classes.

The purpose of this bulletin is to provide information for the seed grower on the identification of rogues and the techniques of roguing pedigreed cereal crops. Roguing is to the multiplication and maintenance of pedigreed seed what selection is to plant breeding.

### Question - WHAT IS A ROGUE?

A rogue is an undesirable plant. There are several types of rogues. The simplest type to recognize is perhaps a barley plant in an oat field, whereas those most difficult to recognize arise from some genetic change within the variety, from mutation, chromosome aberration, or from intercrossing. Rogues also result from simple mechanical mixtures of seeds of other varieties, other crops, or weeds difficult to separate. This type of rogue cannot be easily discounted as such admixtures can occur at many stages in the production of seed. Although they are not true off-types, diseased plants and weeds should be rogued when feasible. In fact, any questionable plant should be rogued to assure that the pedigreed seed produced is of the highest quality possible.

### Question: CAN ROGUING OF GENETIC VARIANTS HAVE ANY POSITIVE EFFECT?

Mutations, aberration and intercrossing in self-pollinated crops occur at definite measurable frequencies, generally at extremely low levels. The seed grower has the responsibility of keeping these variants at the minimum level. He has the additional responsibility of reporting the type of rogues removed and their incidence to his Association. This information is referred to the Plant Breeder. Further, the Select seed grower supplies CSGA each year with a seed sample for variety verification. This exchange of information between the seed grower, the CSGA, and the plant breeder is mutually rewarding.

### Question: WILL ROGUING FOR GENETIC PURITY IN MULTI-LINE VARIETIES MAKE SENSE?

Some modern-day plant breeders place less emphasis on absolute homozygosity in favor of early release of new varieties. Inter-specific crosses tend towards less varietal stability. Current interest in multiple-line varieties will mean less uniformity. Such factors as the foregoing make the pedigreed seed production program increasingly more important. Each step in the program requires more control and care. The norms for the variety will be broader and more complicated and the grower will require more knowledge and more experience to carry out effective roguing.

### Question: HOW CAN ROGUES BE DISTINGUISHED FROM THE NORM OF THE VARIETY?

The same characteristics used to distinguish varieties can be used to recognize and describe rogues. The seed grower must know them well. These characteristics provide the seed grower with a means of checking variant plants when he is going through his crops; they tell the grower what is, and what is not a rogue.

To remove genetic rogues, a grower requires a sound knowledge of the plant form of the variety he is producing. Many factors contribute to the general plant form and these plant characters vary individually in their degree of expression and may be influenced and modified by environment, fertility, and stage of growth. Despite these limitations it is by recognizing a deviation from the general form that a grower will first identify a rogue in the standing crop. The suspect plant can then be checked against the norm to determine if it is in fact a rogue.

A grower must get to know his variety, and to do so should take advantage of organized field days, growers' meetings, and visits to plant breeding stations. At the time of field crop inspection, the grower should accompany the inspector of the Plant Products Division.

### Question: - WHEN AND HOW SHOULD THE CROP BE ROGUED?

General plant form changes throughout the growing season as the plant grows and matures. Once a crop is established it must be rogued repeatedly and systematically to take advantage of the differences as they appear at each stage of growth. It is not sufficient to rogue only once after the crop is fully ripened. Flower parts can only be checked at heading; pubescence of the stems and leaves is evident in the green crop but may be lost by abrasion as the crop ripens:

stem colour is best expressed at early ripening; chaff color does not really develop until full ripening. It is quite obvious that a plan must be established and adhered to .if roguing is to be successful

The first rogues that can be removed are plants of other crop kinds, diseased plants and weeds. Some rogues should be removed as soon as they appear as they will be less visible at a later stage. Plants heading much earlier than the main crop should be suspect and removed. Barley plants in an oat crop must be removed as soon as they head prior to the heading of the oat crop. Weeds may be sprayed with a suitable herbicide at the recommended rate. The chemical weed control measures used should be brought to the attention of the inspector of the Plant Products Division. All rogues should be removed from the field and destroyed.

The land requirements for individual crops and classes of seed are specified by Regulation. In addition to those requirements and particularly for a Select seed plot, land should be carefully chosen. The Select seed plot should be sown in spaced single rows or in sub-plots to assist roguing. Plots seeded too thinly may be difficult to rogue.

Note for Select Seed Growers:

A record describing the rogues should be kept and recorded on the CSGA form provided for this purpose.

### CHARACTERISTICS OF CEREAL PLANTS

The following section deals with those characteristics that are useful for distinguishing varieties and identifying off-types and rogues. Although particular varieties are referred to as examples, a complete outline of variety characteristics is not given, and the reader is therefore referred to the varietal descriptions available from the CSGA or in the Handbook of Canadian Cereal Varieties published by the Canada Department of Agriculture.

#### STEM

The stem of cereals is typical of the grass family, with solid nodes and hollow internodes. Differences in the plant heights of cereal varieties are readily apparent in contrasting plots but of limited value to the seed grower. However, the short, strong-stawed varieties have typically shortened internodes and often a stronger and more erect branching at the crown or base of the plant. Taller plants noted in the field should be checked against the norm for the variety. Often a short-stemmed variety has a more erect inflorescence. Additional stem characteristics are given under each crop kind.

#### LEAF

A single leaf arises alternately from each node of the stem and consists of a sheath and blade. Crop kinds can be readily distinguished in the seedling stage by the presence or absence of ligules and auricles. The ligule is a collar-like appendage that extends upward above the junction of the leaf blade and sheath. The auricles are ear-like appendages that clasp or encircle the stem of barley, wheat, and rye.

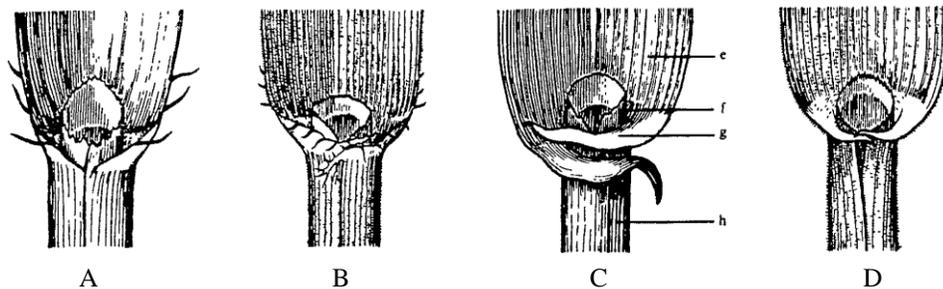


Fig. I - junction of Leaf Blade And Sheath: A, Oats, B, Wheat C, Barley; D, Rye; e, Blade; f, Ligule; g, Auricle; h, Sheath;

- Oats - Auricles absent, leaf sheath and blade mostly glabrous; a few long hairs on the margins of lower leaf blades and on lower leaf sheath of some varieties. Ligule medium length. Blades with about 12 veins usually twisted anti-clockwise.
- Wheat - Auricles short, with blunt tips, hairy; leaf sheath and blade covered with short, fine hair (slight to very hairy); ligule medium length. Blades with about 12 veins, twisted clockwise.
- Rye - Auricles very short, glabrous; leaf sheath and blade covered with short, fine hair (slight to very hairy); ligule short. Blade with about 12 veins, twisted clockwise.
- Barley - Auricles long, slender, glabrous, with pointed tips. Leaf sheath and blade usually glabrous; ligules medium length. Blades with about 20 veins, twisted clockwise.

## INFLORESCENCE

The majority of reliable distinguishing characteristics for rogues are found in the inflorescences, and a knowledge of the parts of the inflorescence is important for a cereal seed grower. There are two types of inflorescences, the oat panicle with its branched rachis, and the spike of wheat, barley, and rye in which the rachis is not branched and its internodes are compacted.

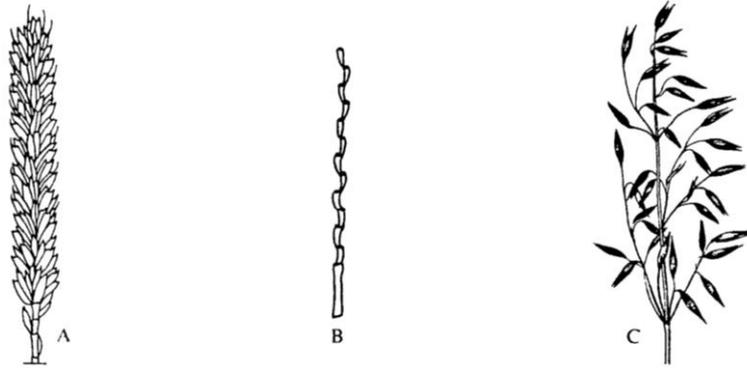


Fig. 2 - Inflorescences: A, Spike of wheat; B, Rachis of spike; C. Panicle of oats.

## SPIKLET AND SPIKLET GROUPS

The spikelet or floret group is the basic part of the inflorescence and occurs singly or in multiples at each rachis node of a spike, and singly at the end of each rachis branch of the oat panicle. The spikelet is composed of two outer glumes and one to five contained florets on a jointed rachilla. The outer glumes must not be confused with the lemma and palea which enclose each floret, and remain as part of the seed unit of oats and barley.

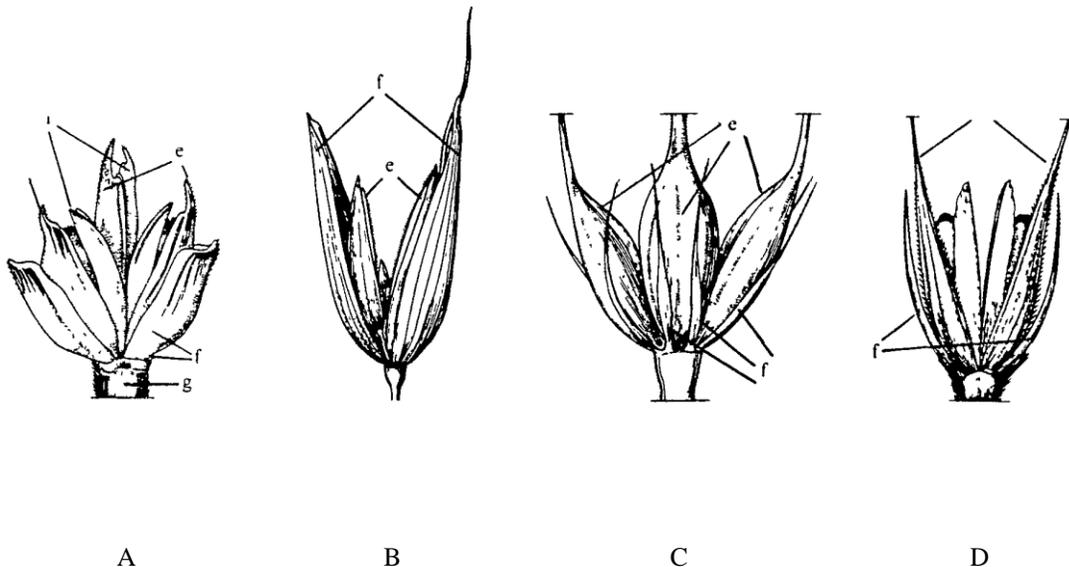


Fig. 3 - Spiklet Arrangements: A, Wheat; B, Oats; C, Barley; D, Rye; e, inner floret; f, outer glumes; g, rachis; h, lemma; i, palea.

Wheat - There is a single spikelet at each rachis node. There may be three to five florets per spikelet.

Oats - There is a single spikelet on each rachis branch. The spikelets have three to five florets. The outer glumes are large and papery.

Barley - Six-row barley has three single-flowered spikelets at each rachis joint. In two-row barley the lateral spikelets are sterile and there is then a single fertile floret at each rachis node.

Rye - There is one spikelet at each rachis node and two fertile florets in each spikelet.

## CEREAL FLOWER

The cereal flower or floret is similar for each crop kind. The florets are borne on jointed *rachillas*. Barley has only one flower per spikelet and the rachilla remains rudimentary. The rachilla is a useful tool for distinguishing varieties and rogues.

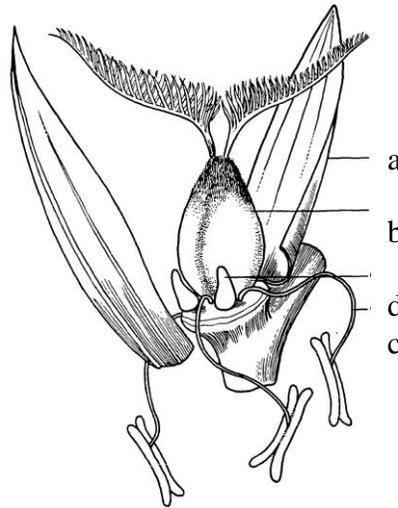


Fig. 4 - Cereal Floret:

(a) palea, (b) pistil with ovary and 2 feathery stigmas, (c) 3 stamens with filaments and anthers, (d) 2 lodicules which are rudimentary in wheat, oats and barley, but in rye they enlarge and open the floret for cross pollination.

## WHEAT

### PLANT FORM

The trained eye of an experienced seed grower will quickly note rogues and off-type wheat plants in a wheat crop by differences in the general form of the heads. The heads can be awned, tip-awned or bald (awnless). The awns are apical extensions of the lemma midrib, they may vary in length. Awnletted mutants are common rogues in bald varieties. The head form can be densely compacted, clavate or club shaped, or long and lax. The term "fusiform" is used to describe a head that is widest in the middle and tapers to both its tip and base.

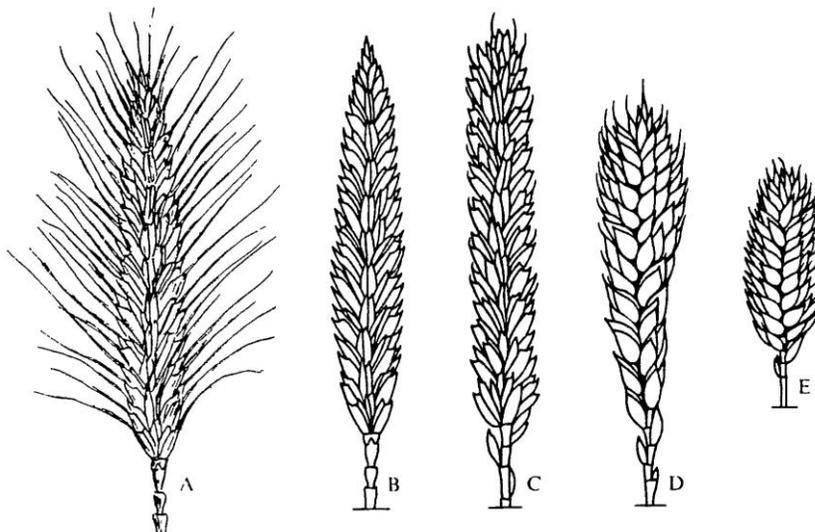


Fig. 5 - Spike Forms. A, bearded; B, bald; C, tip-awned & elongate; D, clavate; E, club.

The color of wheat heads may vary with variety; the glumes can be red or white quite independently of the red or white kernel  
2-23-09

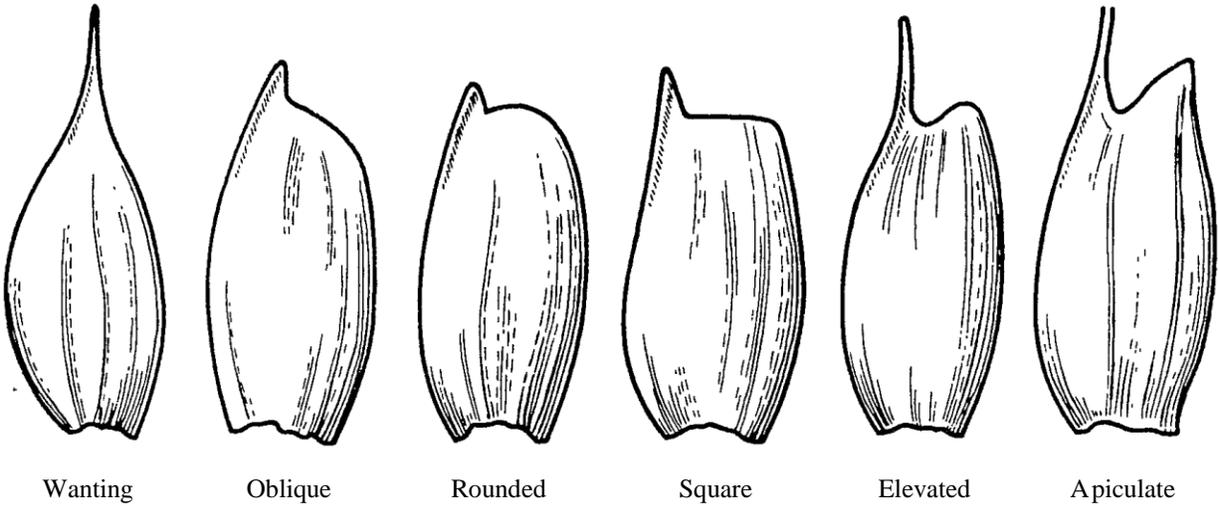
color. Talbot and Genesee are red-chaffed wheats with white kernels, while Kent has both red chaff and red kernels.

The typical wheat stem has hollow internodes but there are a few solid-stemmed exceptions, including the spring wheats Rescue, Chinook and Cypress.

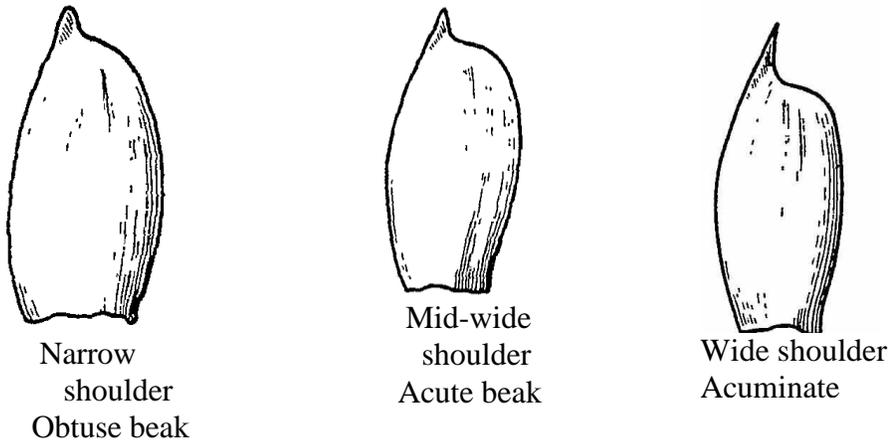
Although the wheat stem is creamy white in most varieties there are a number of purple strawed varieties including the winter wheats Kent and Talbot, and yellow-strawed spring wheats Selkirk and Park. The degree of color is dependent on maturity and a number of growth factors. Therefore, colored straw can be interpreted reliably but its absence in an individual plant is not indicative of a rogue.

The sizes, shapes and colors of kernels and outer glumes are useful identifying characters. Wheat growers should be thoroughly familiar with those characters diagrammed.

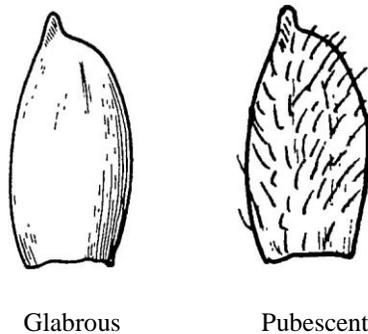
GLUME SHOULDER SHAPES



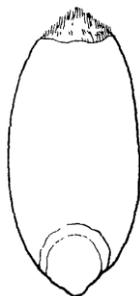
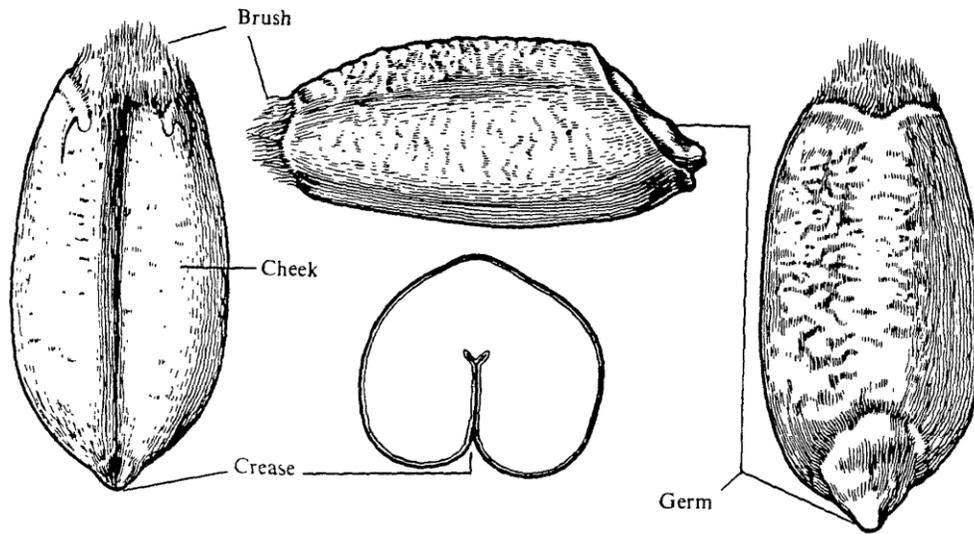
GLUME SHOULDER WIDTHS AND BEAK SHAPES



GLUME COVERING



## WHEAT KERNEL



Elliptical



Ovate



Oval

## SPELTOIDS

Speltoids are common rogues in wheat fields. Genetically they result from chromosome aberration similar to fatuoids in oats. Speltoid plants are usually taller and later than normal for the variety. The heads are longer and thinner than heads of the parent variety, with a distinct taper from the base to the tip. Glumes are strongly keeled with a rather square shoulder and generally are stiffer and cannot be bent away from the spikelet without breaking. The speltoid head does not break up easily at threshing so the kernels usually remain in the glumes and are easily removed at cleaning time. Speltoids are usually self-eliminating because they are late, hard to thresh, and often have low fertility. However, they may appear in each generation. The detection and elimination of speltoids and related off-types are important points of roguing in wheat.

## DISEASE REACTION

2-23-09

Susceptibility or resistance to mildew, rust and smut diseases in some cases may be used as criteria for rogue identification, if the conditions are favorable for the infection and development of these diseases.

#### DURUM WHEAT

This is a distinct and separate species from the common species of bread and pastry wheats. The heads of the durum wheats are always bearded. The outer glumes are covered with a bloom or rarely pubescent. The kernels are keeled, angular and much larger than common wheat. They are amber, harder and more translucent.

#### GLOSSARY

Aleurone	- The outer layers of the endosperm of a cereal seed.
Auricles	- Ear-shaped appendages of the leaf-sheath encircling the stem at the juncture of the leaf-blade and leaf-sheath of many cereals.
Chromosomes	- Rod-shaped bodies, visible under the microscope in the nucleus of the cell at the time of cell division. The number of chromosomes in any species is usually constant.
Chromosome Aberration	- A change in chromosome number or structure resulting in genetic effects.
CuIm	- The stem of the cereals and grasses.
Floret	- Simple flower of the cereals, consisting of the lemma and palea containing an ovary with two feathery stigmas, three stamens, and two lodicules at the base of the ovary.
Gene	- The unit of inheritance arranged linearly in the chromosomes.
Homozygous	- A plant or variety is homozygous for a given character when all its germ cells transmit identical genes for this character.
Inflorescence	- The arrangement of the flowers of a plant.
Internode	- The portion of the stem between two nodes.
Lemma	- The lower of two bracts enclosing the grass flower, sometimes called the flowering glume.
Ligule	- Membranous outgrowth arising from the junction of the leaf-blade and leaf-sheath in many grasses.
Mutation	- A sudden heritable variation that results from changes in a gene or genes.
Node	- The point of the stem from which the leaf arises.
Norm	- The description of the characteristics of a variety.
Palea	- The upper bract enclosing the grass flower.
Rachilla	- A secondary axis in the inflorescence of grasses; the axis of a spike-let.
Rachis	- The axis of a spike.
Spikelet	- A secondary spike, the unit of the inflorescence in grasses, and generally consisting of two outer glumes and one or more enclosed florets.

## Growth Stages In Cereals

### Tillering Stages --

1. One shoot is visible after emergence; additional leaves can be added.
2. Beginning of tillering in plants.
3. Tillers are formed; leaves often twist spirally, some winter wheat may be creeping and prostrate.
4. Start of the erection of the pseudo-stem. Leaf sheaths are also beginning to lengthen.
5. The pseudo-stem is strongly erect. The pseudo-stem is formed by the leaf sheath.

### Stem Extension Stages --

6. The first node of the stem is visible at the base of the shoot.
7. The second node of the stem is formed. The next to the last leaf is just visible.
8. The last leaf is visible, but it is still rolled up. The head is beginning to swell.
9. The ligule of the last leaf is just visible.
10. The sheath of the last leaf is completely grown out. The head is swollen but not yet visible.

### Heading --

- 10.1 The first heads are escaping through the split of the sheath.
- 10.2 One quarter of the heading process is completed.
- 10.3 One half of the heading process is completed.
- 10.4 Three quarters of the heading process is completed.
- 10.5 All heads are out of the sheath.

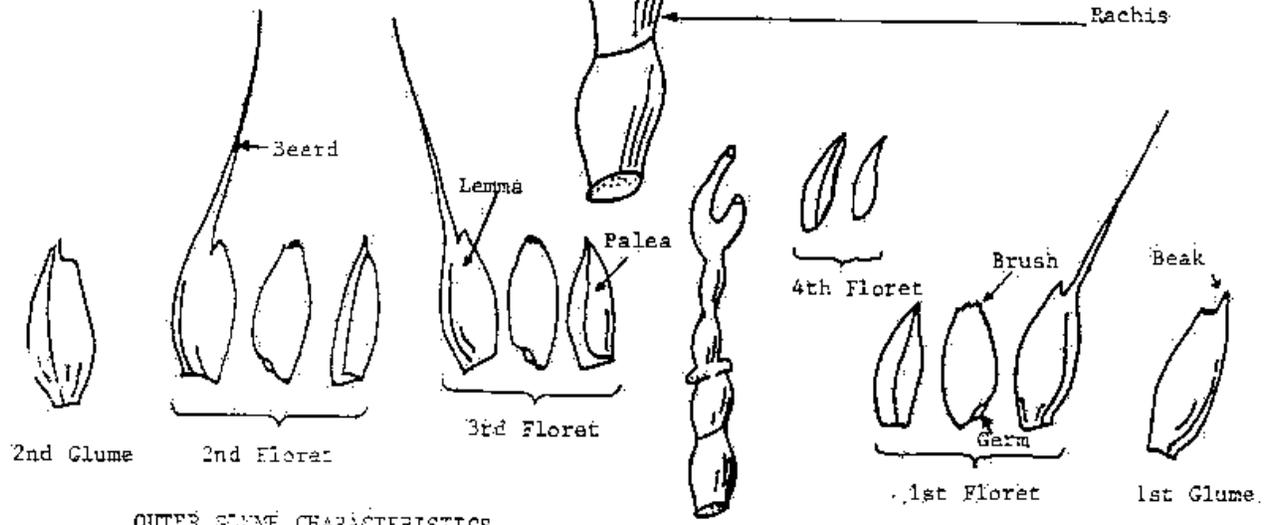
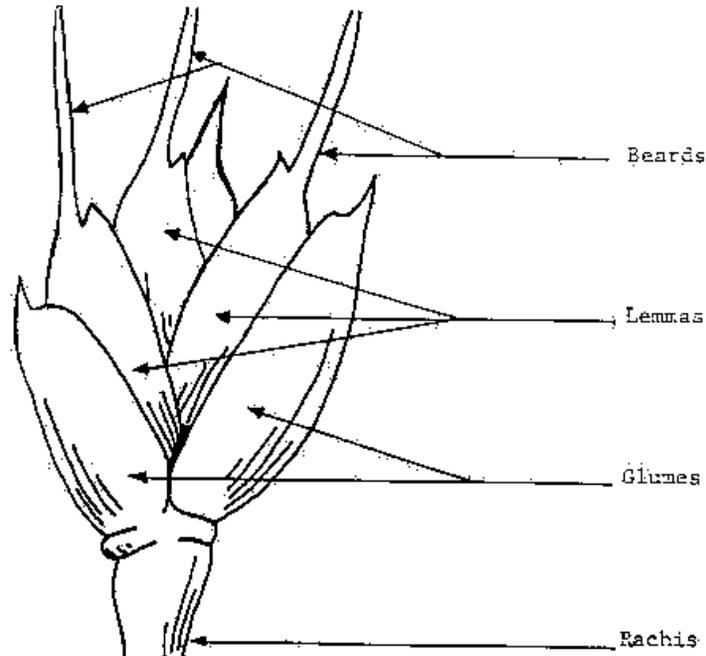
### Flowering --

- 10.6 The flowering stage begins.
- 10.7 The flowering is complete to the top of the head.
- 10.8 The flowering is completed at the base of the head.
- 10.9 The kernel is in the watery-ripe stage; the flowering is completed.

### Ripening --

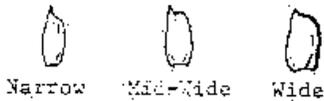
- 11.1 Milky-ripe stage is evident.
- 11.2 The kernels are in the mealy-ripe stage. The kernel is soft but is not dry.
- 11.3 The kernel is hardened. It is difficult to split with the thumb-nail.
- 11.4 The kernel is ripe and ready for harvest. The straw is dead.

NOMENCLATURE  
OF WHEAT HEAD  
AND  
DESCRIPTIVE  
TERMS



OUTER GLUME CHARACTERISTICS

A. WIDTH



B. SHOULDER CHARACTERISTICS

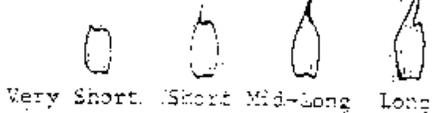
1. Width



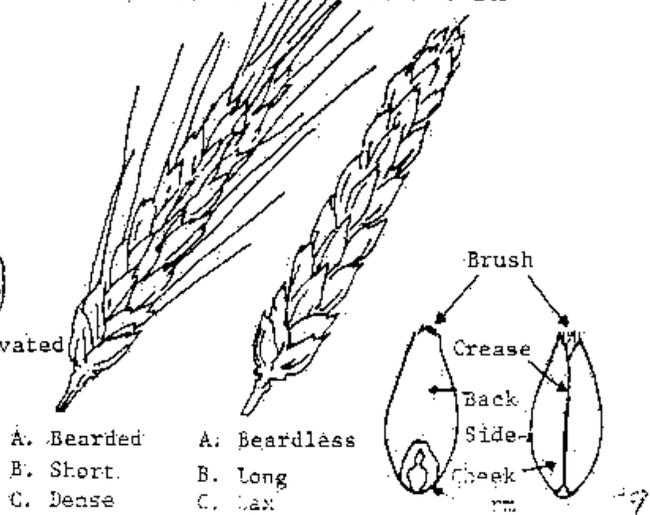
2. Shape



C. BEAK CHARACTERISTICS



HEAD AND KERNEL CHARACTERISTICS



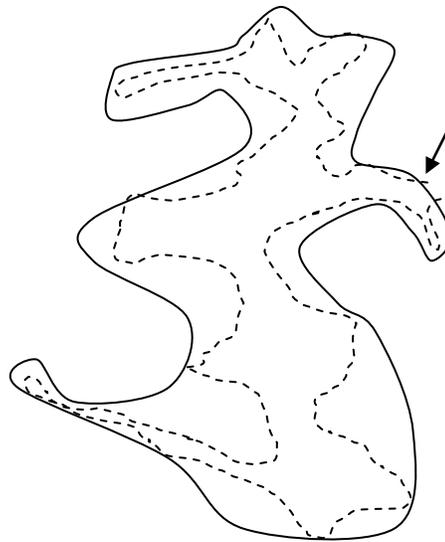
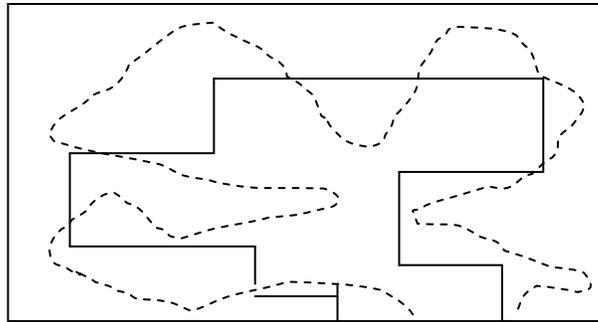
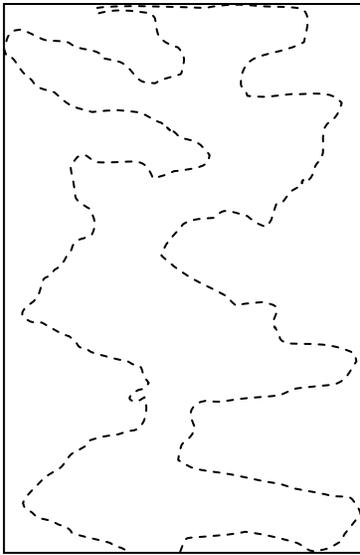
## Sequential Sampling Chart for Wheat, Oats, Barley, Millet

Producers Risk = 0.05 (risk that an acceptable field will be rejected)  
 Consumers Risk = 0.10 (risk that a rejectable field will be accepted)  
 Heads per count = (20 counts minimum; 80 counts maximum)

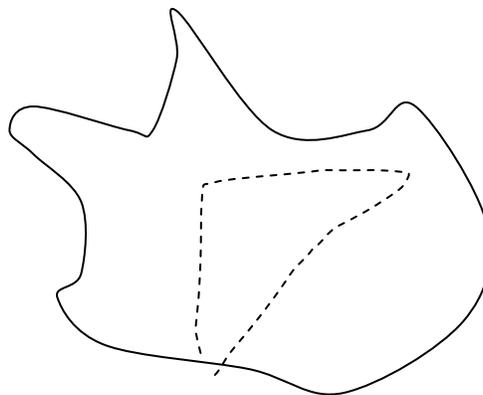
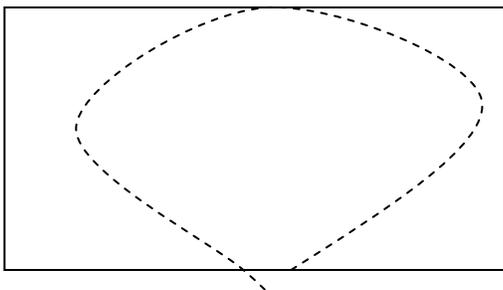
Number Of Counts	Number Of Heads	Registered Class 0.1%		Certified Class 0.02%	
		0.01% Acceptance Number	0.01% Rejection Number	0.02% Acceptance Number	0.02% Rejection Number
20	20000	0	7	0	12
22	22000	0	7	0	13
24	24000	0	8	0	13
26	26000	1	8	1	14
28	28000	1	8	1	14
30	30000	1	8	2	15
32	32000	1	9	2	15
34	34000	2	9	3	16
36	36000	2	9	3	16
38	38000	2	10	4	16
40	40000	3	10	4	17
42	42000	3	10	5	17
44	44000	3	11	5	18
46	46000	3	11	6	18
48	48000	4	11	6	19
50	50000	4	11	7	19
52	52000	4	12	7	20
54	54000	5	12	8	20
56	56000	5	12	8	21
58	58000	5	13	9	21
60	60000	5	13	9	22
62	62000	6	13	10	22
64	64000	6	13	10	23
66	66000	6	14	11	23
68	68000	7	14	11	24
70	70000	7	14	12	24
72	72000	7	15	12	25
74	74000	7	15	13	25
76	76000	8	15	13	26
78	78000	8	15	14	26
80	80000	15	16	26	27

## Inspection Patterns

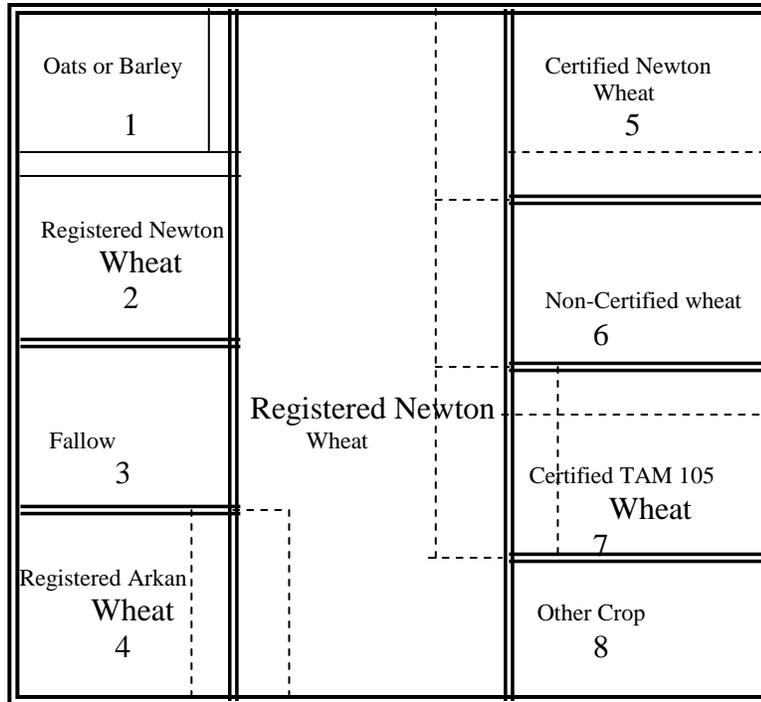
The best inspection pattern for each field will vary but will always be such that the inspector is in close enough proximity to all areas of a field that he or she may easily observe and travel to any part of the field that appears doubtful from a distance for closer examination. Inspector must travel to areas of the field hidden by hills or terraces as well as cove areas.



Poor Inspection patterns such as below do not cover a field sufficiently and greatly increase the probability of missing problems.



## Field Separation and Isolation\* Requirements



\* Separation is spatial distance to prevent mechanical mixing of adjacent crops during harvest. Isolation is spatial distance to prevent cross pollination between different varieties or different crops.

Production of certified seed fields requires careful attention to isolation of the seed crop from possible sources of contamination. The potential for contamination from neighboring fields of other crops or different varieties is a concern and is addressed in the specific standards for each crop.

If there is a question about required isolation distances, check the standards for that crop. A summary is included below which illustrates certified field isolation requirements.

Items below are numbered to match the above diagram.

1. No isolation needed. Six feet of separation needed.
2. No isolation needed. Two feet of separation needed.
3. No isolation needed. Two feet of separation needed.
4. 30 feet of Reg. Arkan and 30 feet of Reg. Newton needed for isolation. Must be harvested as grain.
5. 30 feet of Reg. Newton needed for isolation, may be harvested as seed with the certified class; 20 feet of certified Newton needed as isolation from non-certified wheat; must be harvested as grain.
6. 30 feet of Reg. Newton needed as isolation; must be harvested as grain.
7. 30 feet of Reg. Newton and 20 feet of Cert. TAM 105 on two sides needed as isolation; must be harvested as grain.
8. No isolation needed; a two foot separation from the certified field is needed .



**INSTRUCTIONS TO APPLICANT- Print clearly and legibly**

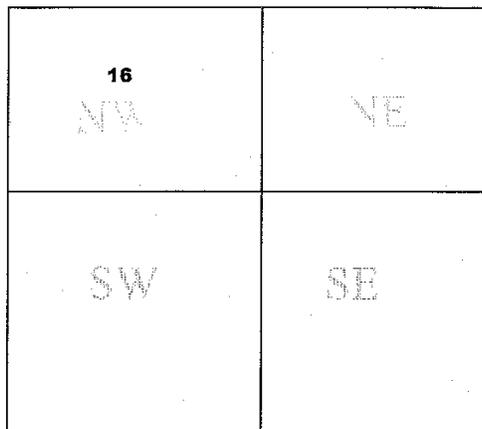
A. Fill out upper portion of this form COMPLETELY and ACCURATELY.  
-Complete address, legals, directions and phone numbers of Applicant  
-Diagram field on map (map = 1 section, 1/4=160 acres) including ditches, waterways, etc., give legal description of field and clear directions including road names, landmarks, which side of road or lane, etc. "Call for directions" is not acceptable.  
-Field name or ID, variety, class being produced, seed source # (certification number), seed class planted, previous crop, acres, planting date. If seed was purchased, attach seed tag or bulk sales certificate.

B. Return original and yellow copy to KCIA before filing deadline to avoid late charges.

Field Name or ID: 8  
Variety: 9 Acres: 10  
Class being produced (circle): Fnd Reg Cert QA **11**  
Seed Source #: 12 (attach seed tag or bulk certificate)  
Seed class planted (circle): Fnd Reg Cert QA **13**  
Planting Date: 14  
Previous Crop / Variety 15

**APPLICANT:**

**1**  
Phone 1: **2** Phone 2:  
Distance and Direction of residence from nearest town -- **3**  
Legal description of residence or business  
Qtr. \_\_\_\_\_ Sec. \_\_\_\_\_ Twp. \_\_\_\_\_ Range. \_\_\_\_\_ Co. \_\_\_\_\_ **4**  
Field legal description: Qtr. \_\_\_\_\_ Sec. \_\_\_\_\_ Twp. **5** Range. \_\_\_\_\_ Co. \_\_\_\_\_  
Distance and direction of field from nearest town **6**



which side of road or lane: \_\_\_\_\_

Does KCIA need to contact the contract grower prior to inspection? NO  YES

Contract Grower \_\_\_\_\_ Phone 1 **7** Phone 2 \_\_\_\_\_

**DO NOT WRITE BELOW THIS LINE: (KCIA use only)**

**17** Isolation: N: \_\_\_\_\_ S: \_\_\_\_\_ E: \_\_\_\_\_ W: \_\_\_\_\_ **18** Maturity: \_\_\_\_\_ **19** Estimated Yield (Bu.): \_\_\_\_\_

**20** Off-types \_\_\_\_\_

**21** Variants \_\_\_\_\_

**22**

Pts/Count	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total	

**23** 0 = none, 1 = Trace, 9 = Very Heavy.

<p><b>Prohibited Weeds</b></p> <p>___ Bur Ragweed ___ Canada Thistle ___ Field Bindweed ___ Hoary Cress ___ Johnsongrass ___ Leafy Spurge ___ Musk Thistle ___ Quackgrass ___ Russian Knapweed ___ <i>Sorghum almum</i></p>	<p><b>How Controlled</b></p> <p>_____ _____ _____ _____ _____ _____ _____ _____ _____ _____</p>	<p><b>Objectionable Weeds</b></p> <p>___ Cheat and/or Chess ___ Downy Brome ___ Dock (<i>Rumex spp.</i>) ___ Hairy Vetch ___ Hedge Bindweed ___ Jointed Goatgrass</p> <p><b>Other Weeds</b></p> <p>_____ _____</p>	<p>___ Morningglory ___ Pennycress ___ Wild Buckwheat ___ Wild Mustard ___ Wild Onion or Garlic ___ Wild Oats</p> <p><b>Other Crops</b></p> <p>___ Wheat ___ Oats ___ Rye ___ Triticale ___ Barley</p>	<p><b>Diseases</b></p> <p>___ Common Bunt ___ Loose Smut</p> <p><b>Insects</b></p> <p>_____ _____</p> <p><b>Damage</b></p> <p>___ Lodging (%) _____</p>
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**24** Recommendation: PASSED/CSI REJECTED DEFERRED PASSED-QA REPORT ONLY - QA

**25** Remarks: \_\_\_\_\_

**26** Inspector's Signature \_\_\_\_\_ Date \_\_\_\_\_

**27** Copy Distribution : Applicant: Return original and yellow copy to KCIA, keep pink copy Inspector: After inspection return original to KCIA, yellow copy to applicant

## Completing the Inspection Report If *myfields* Does Not Support The Crop You Are Inspecting

NOTE: Techniques are the same for different report form used when *myfields* is available

The purpose of this instruction is to state in an unambiguous manner, the minimum expectation of the field inspector when completing the Inspection Report.

A properly completed inspection report is necessary to allow KCIA staff to ascertain final certification status of a field based on the observations of field inspectors. Due to this dependence upon “third-party observation”, the field inspector is not only required to conduct a thorough and competent inspection, but he/she must also report to KCIA in a clear concise manner. Regulations require KCIA to maintain certain information regarding the fields that it certifies. Missing or incorrect information on the inspection report inhibits KCIA’s ability to perform its duty and is sub-optimal performance by the inspector.

The **Application for Field Inspection** is a dual-purpose document serving both as the applicant’s submission of the field to KCIA and as the final inspection report. The upper half contains the applicant’s contact information and field description. The lower half is completed by the inspector at inspection.

The crop inspected will dictate which application is used. KCIA has application forms for small grains, soybean, hybrid sorghum, corn, and miscellaneous crops. The wheat, soybean, and miscellaneous crops are similar in appearance except that the weeds listed for wheat and soybean differ according to each crop’s standards, and disease and insects. The miscellaneous crop form, though similar in appearance, requires the inspector to write in weeds and diseases according to the crop standards for the crop of inspection. Regardless, information conveyed by the inspector must be complete and concise. For the purpose of demonstration, the small grains form will be used since wheat is the most common crop that KCIA inspects. Refer to the accompanying form. Note that for reference, each area on the form is numbered.

Every field application received is given an Application Number (**A**) referred to the “A” number since the number is a 5-digit number preceded by A, i.e. A98756. This is the number used to track the field through KCIA records.

Note: These numbers are for instructional purposes and do not actually appear on the form.

**(1) APPLICANT:** This is the applicant’s name or business name and address, and phone numbers **(2)**. This is the person responsible for the certification of the field and is the inspector’s primary contact. Sometimes the applicant will contract with a farmer to grow the crop. If the applicant wishes you to contact the contract grower he/she will indicate so in **(7)** and provide contact information. The applicant provides directions **(3)** and the legal description **(4)** to his/her homestead or place of business so that the inspector and the applicant can meet up. The applicant also provides the legal description **(5)** and written directions **(6)** to the actual field. The field map **(16)** grid represents a 1-mile square section divided into four quarter-sections. The applicant should render a drawing here, approximating the shape and location of the field and any key landmarks such as waterways or road names that would aid in positive identification of the field.

Field Name or ID **(8)** is the name or number given to the field by the applicant, i.e. “Hickman 40”. Often, the applicant will simply choose to identify a field by the KCIA field number applied to the field **(A)**. The variety grown **(9)** and the size of the field **(10)** should be verified upon arriving to conduct the inspection. The class of seed being produced **(11)** will dictate which purity and isolation requirements in the crop standards will govern the inspection. The applicant must verify seed source **(12)** by submitting a valid tag or certificate justifying the class of seed planted **(13)**. The date of planting of the crop **(14)** may aid in predicting when inspection will be needed.

The previous crop/variety **(15)** lists what was last growing in the field. The inspector must confirm the accuracy of this listing by noting what stubble is present and writing “OK”, “No” or “Clean tilled” next to the entry for previous crop/variety. If stubble does not match what is listed state what if any stubble is present. The inspector will not be able to verify what variety was present, only what stubble is present.

**17 Isolation.** Each crop has isolation requirements specific to that crop. The crop specific certification standards will list the required distance the field must be from any other source of contaminating pollen. Isolation distances will also differ according to the class of seed (Foundation, Registered, or Certified) being produced. For a field, isolation requirements will either be met or not. If a field complies with the standard place a check mark (✓) for each border that complies. If a field border does not comply with standards place an “O” for that border then in the Remarks **(25)** put a similar “O” and explain why that border does not meet standards.

Example: N:\_✓\_ S:\_✓\_ E:\_O\_ W:\_✓\_

Remarks: O- isolation only 10 feet, need 20.

**18** Maturity. It is sufficient to list maturity as “milk”, “soft dough”, “hard dough”, or “Ripe” for small grains as taught in training. Soybeans will be listed as the V-stage (V1...V12) or R-stage (R1...R8), whichever is appropriate at the time of inspection. For other crops inspector training will clarify the appropriate maturity stages.

**19** Estimated Yield. If possible, enter the estimated yield of the applicant. Otherwise, make the best estimate possible using techniques covered in training. Even though this is an estimate, strive to make it as reflective of the potential yield as possible. Average yield will be affected by poor areas of the field as well as by environmental issues such as drought, excessive moisture, disease, lodging etc. If there is an issue that may impact yield, the inspector should note it in the appropriate place in (**23**) or in Remarks (**25**). Example: If the south third of the field was water damaged by flood water, the inspector could make the entry in remarks “ south third of field flooded”.

**20** Off-types: Off-types are plants of the same crop type (i.e. wheat plants) that are present but do not match either the description of the cultivar or allowable variants, or that match the description of allowable described variants but are present in a frequency greater than allowed by the breeder description of the variety/cultivar. All off-types should be listed even if only one is seen and none are counted in the plant counts. If more than one type of plant off-type is found all should be noted.

Example: Off-types -1-taller, red chaff    2- white chaffed, later, longer beak

**21** Variants: Variants are those plants of the same crop type that are part of the cultivar description. An example might be a cultivar that has a constant number of taller plants that are similar in all other characteristics. Allowable variants for each variety should be provided to inspectors prior to inspection. List all variants that are seen, even if only one plant is seen in the field. This will help explain its presence in the next generation should it appear.

**22.** Plant counts. Results of plant counts **must be** recorded, even if no off-types or variants are counted. Each inspector must be capable of conducting accurate plant counts. This generally means practicing stepping off a given length until it can be done in a repeatable fashion. Plant counts are only useful if they actually give a good estimate of what is in the field. Plant counts must be **taken at random places throughout the field** in order not to incorporate inspector bias. Several methods may be used to keep counts random. One way is to decide roughly how many counts must be made, then mentally, evenly distribute those counts over field and as you approach a preset area move a certain distance (i.e. 13 rows over and 30 paces up to start your count. This helps eliminate artificial and unintended bias in the count by diminishing the subliminal desire to be drawn toward a particularly good or bad area of the field to conduct the count.

There will be times when a count may contain so many off-types that the field could theoretically be rejected on the basis of that one count, yet the inspector can clearly see that it is not representative of the field. For example, one off-type wheat plant may contain so many tillers that the maximum tolerance is exceeded on the first count. In this case continue to make random counts as usual. On the basis of the remaining counts, the inspector will have to decide if that one count was simply an anomaly and perhaps should be tossed out and another count taken, or, if more counts are needed until a decision can be made using the sequential sampling chart. A field cannot be rejected until it can be clearly shown to contain more than the allowable off-types or variants. Tolerances for off-types will be listed in specific crop standards or guidelines while the variants, which are cultivar specific, will be provided to the inspector. Overall, keep in mind that the plant counts should accurately represent what is in the field and do not hesitate to take more random counts until a clear decision can be made.

The column “Plts/count” is the number of heads or plants per count. For example, if you counted 1000 wheat heads per count then you would enter “1000” in this column.

**23.** Depending on the form used or the crop inspected, this part of the form will list Prohibited and Objectionable weeds, and certain diseases and insects listed in the standards, or it may contain simply blank lines to be filled in by the inspector. Regardless, the goal is to list what is seen and to give KCIA an idea of the severity of the problem. If prohibited weeds are seen, are they controlled or uncontrolled? How heavy is the infestation? If they are controlled, indicate this by short phrases such as “staked” or “sprayed” or “staked and sprayed”. If only one plant is seen plant, put a “1” for a trace, to the left of it’s listing, or if it is present throughout the field you might put a “9” for heavy. Objectionable weeds since they do not necessarily lead to field rejection unless they inhibit inspection, will receive only a number indicating their abundance. If a common weed (one not explicitly listed in standards) is present and the inspector feels it should be mentioned, list it under common weeds.

In our sample form there are spaces for other crops. Using wheat as an example, the standards list limitations on the amount of some crop types that may be present. Triticale and rye are prohibited crops and if present will be cause for rejection. However, if oat or barley plants are present, there can be no more than 1 to 2 heads per 10,000 heads depending on the class of seed being

produced. Since there is a tolerance listed for oat and barley, obviously, these will be included in your plant counts and the results should be listed in the remarks i.e. “saw only two oat plants”, or “less than 1 in 10,000” or “trace of oat”. If crops other than those listed are present, a remark listing type and frequency is in order.

Again, in the case wheat, there are limits to the diseases loose smut and common bunt that will need to be handled similarly to “other crops”. If insect damage is seen, it is appropriate to list the insect and the extent of damage. Likewise, if the crop is damaged by lodging, or flooding, or drought, etc., it is likewise appropriate to list the type and the extent of the damage.

**24. Recommendation-** Upon completing the field inspection, the inspector should have an accurate picture of the field on which to make a recommendation. The recommendation is just that. It is **not** the final decision to allow the field to proceed with certification as that is the sole responsibility of KCIA. The recommendation of the inspector informs the KCIA personnel that in the inspector’s opinion, the field either meets the field requirements, or should be rejected, or needs further consultation.

Generally, the inspector’s recommendation will stand provided the inspection report is clear and unambiguous. Should the inspector make a mistake, such as stating a noxious weed is present but not stating whether it is controlled or uncontrolled, then the field will be rejected until the omission can be clarified. **This is why it is important to be complete and concise when completing the inspection form.**

**25. Remarks –** As mentioned throughout this guide, this area is for inspector use to clarify issues or explain findings. Use this to provide additional information regarding isolations, damage, purity etc. as needed to aid KCIA in making a final decision.

**26. Inspector’s Signature – and Date.** The signature and date indicate who conducted the inspection and indicates when the inspection was completed. A report must be signed and dated to be accepted.

**27. Document distribution –** Depending upon the form, there will be one or more carbon copies. In the case of the small grains form there are three: The white, top, or original copy, the second or yellow copy, and the third or pink copy. Upon completion of the application, the applicant keeps the pink copy for his/her records and sends the original and yellow copies to KCIA. The original and yellow copies are sent to the inspector who conducts the inspection, completes the form (both copies) and gives the yellow copy to the applicant. The original or white copy is submitted by the inspector to KCIA in a timely manner.

## Plant Counts

### Be sure to Record Your Plant Counts in your *myfields* or your paper report

Plant counts are important. They are used to decide if off-types plants are present at a frequency that must lead to field rejection. Care must be taken to assure the plant counts convey an accurate picture of the purity of the cultivar in the field.

An experienced field inspector can generally view a field and immediately form an opinion as to the cultivar purity in that field. However, without reporting the actual results of plant counts, the inspection is incomplete and KCIA does not have needed information to recommend acceptance or rejection. Plant counts **must be recorded** on the inspection report.

Plant counts must be completely random and taken throughout the field. Non-random plant counts will not give an accurate picture of the field, as spots chosen for the counts may be unintentionally selected for the presence of, or lack of, off-types.

In addition to random counts, the inspector must have the ability to accurately measure the correct number of heads or plants to be counted. Counting less than, or more than, the desired number of plants or heads per count, can lead to an inaccurate assessment of a field. For example, if an inspector inadvertently counted 1500 heads instead of 1000, and, counted one off-type head, he/she would erroneously report the results of that count as 1 off-type per 1000 rather than the true count of 0 off-type per 1000 or 1/1500, whichever of the two was in reality, accurate.

The inspector therefore, needs to know how to make random counts and to count the correct number of plants or seed heads. These two are vital in making accurate plant counts. Keeping counts random is not difficult. It involves not letting conscious or unconscious thought influence beyond the general area of the field where a count is to be taken.

The inspector must avoid being drawn toward, or away from, off-types plants. Rather, an indirect manner of deciding the location of each count should be used. Some inspectors will throw an object such as a hat and begin a count where the hat lands. Others may decide that whenever an area of a field is reached and a count needed, they will automatically move a given distance before beginning the count. For instance, an inspector, viewing the field prior to entering it may get a feel as to how many counts must be taken in each section of the field. After beginning the inspection, and upon reaching a point where a count is needed, the inspector says, "okay, I need a count so I will move 50 paces up and 15 rows over and begin my count there". Though not statistically random, in either case the inspector has not allowed what might be present influence his/her decision to make a count at that location.

Having "randomly" chosen the site for a plant count, the inspector must now deliberately view the appropriate number of heads or plants (generally 1000 heads or plants) and count the number of off-type heads or plants, diseased heads or plants, and variants, the number of each is recorded for each plant count taken. The correct number of heads or plants must be viewed to avoid over- or under-estimating the number of questionable plants seed.

Upon entering each field, the inspector must obtain a reasonable estimate of the number of plants or heads per foot of row. This is done by selecting five or more spots that look typical, measuring off a foot distance, and counting heads or plants. Longer distance may be used to obtain average number and indeed in some instance may be more accurate. The average of these samples becomes the plant/head per foot that will dictate the distance of row that viewed during each count for that specific field in order to include 1000.

The inspector needs a method of measuring the calculated distance. This may be done as simply as stepping heel-to-toe, measuring with a tape, or pacing off the required distance. Pacing off a distance requires practice. The inspector must be able to accurately pace off distances in a repeatable manner. Generally, an inspector will learn to pace off a given distance, say ten feet, then use multiples of this to estimate the distance for the count. Pacing is acceptable and quicker if off-types are not common in a field and rejection is not likely. However, this "casual count" is not sufficient if a field is near rejection. In these cases, more accurate measurement using a tape or heel-to-toe is required.

It is quite common to see off-types in the field and not catch any of them in your counts. Unless the inspector purposely avoided off-types when making counts so that the counts were not random, having no off-types in counts indicates that there is not a problem in the field. Also, a specific plant count in a field, deals only with that specific row(s) that is being counted. Often you may count a row and notice that there is an off-type in the next row. For the purpose of plant counts, that off-type has no bearing and should be ignored.

It is not as easy when off-types appear in the plant counts. If, at the end of the counts, off-types remain below the acceptable tolerance level for the crop as defined in crop standards or guidelines, then the field can be passed. If, however, the number of off-types, or variant plants exceed limits described for that crop and cultivar, then additional counts must be taken until the field can be accepted or rejected on the basis of the **sequential sampling** chart.

**All plant counts must be recorded in the inspection report.**

## Estimating Yield

*Myfields* will calculate yield of wheat but will not accurately estimate the yield for other crops. To calculate wheat yield in *myfields* you will need to know heads per foot of row, avg spikelets per head and average seed per spikelet, which you will enter into *myfields* for the estimated yield. For other crops it will come down to experience, though by estimating the same yield components as for wheat, an equation might be used to estimate yield. Remember to get a fair representation of heads, not all the best or all the worst.

If your experience does not allow you estimate yield for oat, barley, rye or triticale crops (ie certified fields of these, not the contaminants in a wheat field) then it might be better just to note poor stand, thin stand or good stand rather than actually give a bushel estimate.

Below

Obtaining an accurate estimate of yield is difficult. The number of samples and the time it takes to thresh or split pods detracts from the inspector's other duties. It is acceptable to ask the grower his/her estimate of yield and record that in the inspection report. If however, the inspector must make a yield estimate the following formulas may be useful.

Wheat

$$\text{Wheat Yield} = \frac{(\text{No. heads/foot of row}) \times (\text{No. spikelets/head}) \times (\text{No. kernels/spikelet})}{\text{row spacing in inches}} \times 0.48$$

Soybean

$$\frac{\text{*Number of plants} \times (\text{pods/plant})}{60} = \text{bu/acre}$$

\*Number of plants = average number of plants per foot of row x row

Row width	Factor
7.5	75
15	35
30	17.5

factor

Determine average number of plants or heads per foot by counting 5 or more representative foot-long sections of row and averaging. Use this number directly in the wheat equation but for soybeans the average number of plants must be multiplied by the factor corresponding to the row with used in the field. Use several representative heads or plants to determine averages for the other yield components in the equations and calculate the yield. Familiarity with the crop will aid yield estimation. Some crops, such as foxtail millet, or canola, have yields expressed in pounds per acre. Knowledge of the average yield for the crop in the county of inspection will aid yield estimation along with a feel for condition of the crop, i.e. poor, fair, good, and excellent.

Factors that determine the condition of the crop include, but are not limited to, plant stand (population, skips), disease (prevalence, severity), drought stress, lodging, insect damage, hail damage, hot weather. These can all impact yield in a negative manner.

For other crops that may be inspected, either the inspector will be given yield estimate equations or will be expected to attain the information independently.

## Diagnosing White Heads In Wheat\*

\*Plant Disease Alert, May 17, 1999, KSU Extension Plant Pathology, Bob Bowden author.

When wheat heads die prematurely, the symptom is called a white head. Depending on how early it happens, yield loss can be moderate or severe. Many different biotic and abiotic factors can cause white heads. In many cases, the cause of the white heads can be diagnosed by the pattern of symptoms within the plant. For example, scab attacks the heads directly; thus leaves and stems below the heads remain green. In contrast, sharp eyespot girdles the stem, so individual stems are killed along with the heads. Likewise, the field pattern can be very helpful. Drowning causes a patchy field pattern, but stem maggots attack plants fairly randomly. Sometimes additional features help confirm the diagnosis. For instance, take-all root rot causes blackened roots and blackened stem bases. Try using the table...to help diagnose white heads in wheat.

Malady	Stems and Leaves Remain Green?	All Tillers On Plant Affected?	Field Pattern	Other Diagnostic Features
Sharp eyespot	No	No	Random	Lesions girdling base of stem
Take-all root rot	No	Yes	Patchy	Roots and stem bases blackened
Drowning	No	Yes	Patchy	Low areas of field
Drought Stress	No	Yes	Patchy	Plants stunted; especially on poor soils and upland areas of field
Dryland root rot	No	Yes	Patchy or random	Pink or white fungus inside lower stem
Cephalosporium Stripe	No	Yes	Random	1 or 2 wide yellow stripes on leaves
Stem maggot	Yes	No	Random	Head pulls out easily; stem chewed off
Hail	Yes	No	Random	Heads or stems broken
Frost Injury	Yes	No	Random	Florets on all or part of head fail to develop to full size
Scab	Yes	No	Random	All or part of head turns white and has white or pink chalky grain
Heat scorch	Yes	No (shorter tillers may escape damage)	Edge of field or patchy	Often worse downwind from hot bare ground
Herbicide drift	Yes or No	No (shorter tillers may escape damage)	Edge of field	Often worse downwind from row crops or stubble fields

**Downy brome**

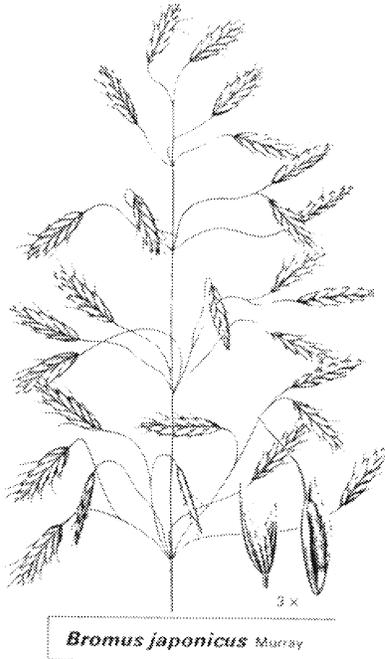
inflorescence



*Bromus tectorum* L.

**Japanese brome**

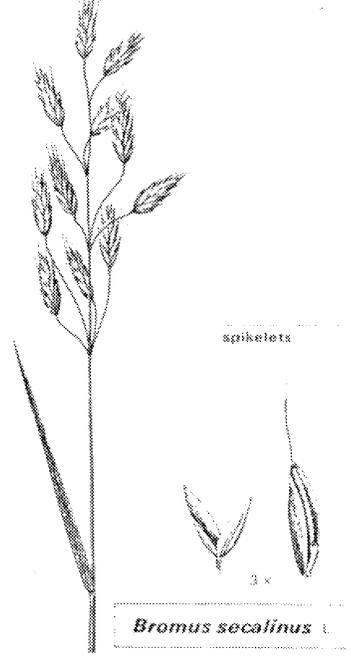
inflorescence



*Bromus japonicus* Murray

**Cheat**

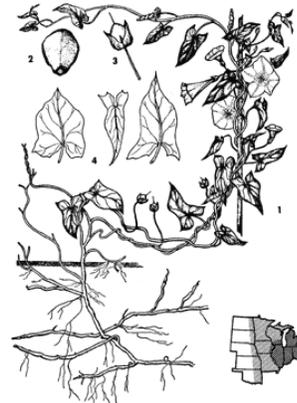
inflorescence



*Bromus secalinus* L.



Field Bindweed



Hedge Bindweed



Honeyvine Milkweed



Wild Buckwheat

**FIELD BINDWEED**, *Convolvulus arvensis* L. **1**, plant in flower; **2**, seed pod, entire and in cross section; **3**, seed; **4**, variations in leaf shape. **Perennial**, reproducing by seeds and rootstocks. **Root** system extensive; may go down 20 to 30 feet (6 to 9 m). **Stems** smooth, slender, 2 to 7 feet (0.6 to 2 m) long, twining or spreading over surface of ground. **Leaves** ovate with spreading basal lobes. **Flowers** white or pink, funnel-shaped, about 1 inch (2.5 cm) across, usually borne singly in the axils of leaves. Flower stalk has 2 bracts 1/2 to 2 inches (1.3 to 5 cm) below the flower, which distinguish this weed from hedge bindweed. **Seed pod** egg-shaped, usually containing 4 seeds. **Seeds** dark brownish-gray, roughened, about 1/8 inch (3 mm) long, with 1 rounded and 2 flattened sides. **Found** in and able to persist and spread in all noncultivated areas and under most cropping systems. One of the most troublesome weeds in the region. Also known as creeping jenny.

**HEDGE BINDWEED**, *Convolvulus sepium* L. **1**, plant in flower; **2**, seed; **3**, seed pod; **4**, variations in leaf shape. **Perennial**, reproducing by seed and fleshy creeping rootstocks. **Roots** extensive but relatively shallow. **Stems** smooth, 3 to 10 feet (0.9 to 3 m) long, twining on plants or trailing on surface of ground. **Leaves** large, alternate, usually sharp pointed at tip, basal lobes large. **Flowers** large, 1-1/2 to 2 inches (3.8 to 5 cm) across, white or pinkish. The flower bud and later the lower part of the flower and seed pod are enclosed in 2 leafy bracts. **Seed pod** about 3/8 inch (9 mm) in diameter, egg-shaped, containing 2 to 4 seeds. **Seeds** slate-colored to black, dull, usually with 1 rounded and 2 flattened sides. **Found** in cultivated fields, fence rows and waste areas, especially on bottomlands. Less drought-enduring than field bindweed, but under humid conditions usually a more serious problem.

**HONEYVINE MILKWEED**, *Ampelamus albidus* (Nutt.) Britt. **1**, portion of plant; **2**, seed pod; **3**, seed. **Perennial**, reproducing by seeds and by long spreading roots. **Stems** smooth, slender, twining, without milky juice. **Leaves** smooth, heart-shaped, pointed, with long petioles, in pairs at the nodes on the stem. **Flowers** small, whitish, borne in clusters on stalks from the axils of the leaves. **Seed pod** similar to that of common milkweed but smooth and green. **Seeds** brown, flattened, oval, with a tuft of silky, white hairs at tip. **Found** in cultivated fields and fence rows, especially in areas with fertile, moist soil.

**WILD BUCKWHEAT**, *Polygonum convolvulus* L. **1**, entire plant; **2**, mature seed; **3**, vine entwined around stem of grass. **Annual**, reproducing by seed. **Stems** smooth, slender, twining or creeping, branched at base. **Leaves** alternate, heart-shaped, pointed with smooth edges. **Flowers** small, greenish-white, borne in clusters in leaf axils. **Seeds** triangular, somewhat shiny, black; often covered with a dull brown, rough hull. **Found** in noncultivated areas and under most cropping systems. It is often mistaken for [field bindweed](#), but the annual habit, black, shiny 3-cornered seeds, heart-shaped leaf, and minute flowers set it apart. It is a serious weed and often reduces crop yields and quality; its seeds are difficult to remove from crop seeds.

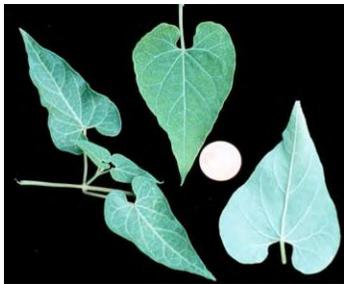


-----Field Bindweed-----



-----Hedge Bindweed-----

Ivyleaf MorningGlory

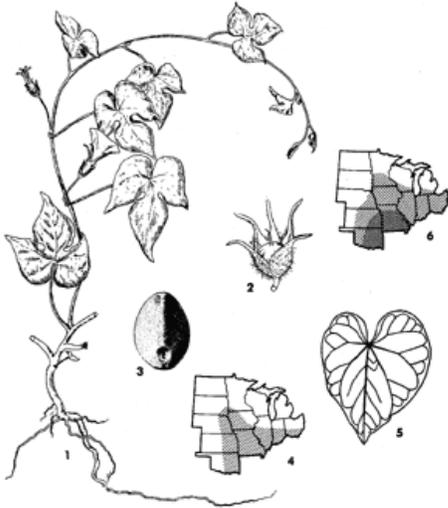


Honeysuckle Milkweed

-----Wild Buckwheat-----



Buckwheat Sdling



Ivyleaf Morningglory

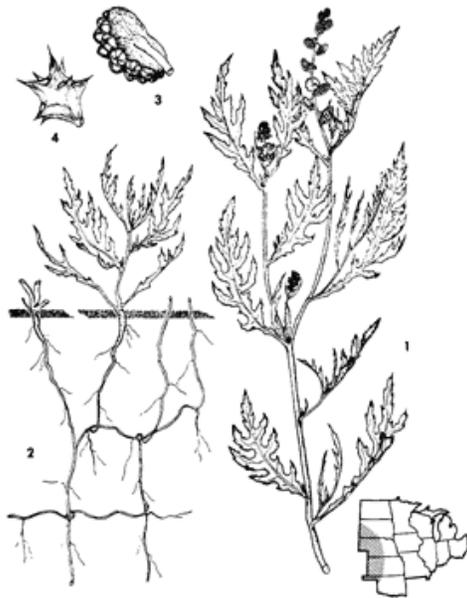


Bigroot Morningglory

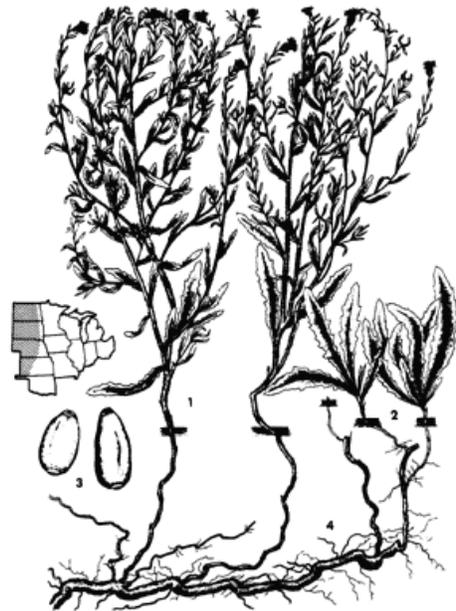
**IVYLEAF MORNINGGLORY**, *Ipomoea hederacea* (L.) Jacq. **1**, portion of plant; **2**, seed pod surrounded by calyx; **3**, seed; **4**, distribution. **Annual**, reproducing by seed. **Stems** hairy, twining or spreading on ground. **Leaves** usually 3-lobed, alternate, hairy. Plants with entire leaves occur rarely, becoming more common toward southern part of region. **Flowers** funnel shaped, purple or blue varying to white, borne singly on long stalks. **Seed pods** egg-shaped, partly covered by bristly calyx, usually with 4 to 6 seeds. Sepals lanceolate, narrowed from below the middle into a slender, recurved tip. **Seeds** about 1/4 inch (6 mm) long, dark brown to black, with 1 round and 2 flattened sides. **Found** in gardens, fields, and waste places. A troublesome weed in cultivated fields, especially corn and soybeans, where it ties plants together before harvest.

**TALL MORNINGGLORY**, *Ipomoea purpurea* (L.) Roth. **5**, leaf; **6**, distribution. Very similar to the above species. **Leaves** are larger, heart-shaped, very rarely lobed. **Flowers** blue, purple, white, or variegated. Sepals lanceolate to oblong, acute to acuminate.

**BIGROOT MORNINGGLORY**, *Ipomoea pandurata* (L.) G. F. W. Mey. **1**, portion of root; **2**, portion of vine with flowers; **3**, seed pod; **4**, seed. **Perennial**, reproducing by seed and from roots. **Roots** yellowish white, enlarging greatly so that they may weigh many pounds, buried in the soil below the plow line. **Stems** trailing or twining on plants, 2 to 10 feet (0.6 to 3 m) long, smooth, often purplish. **Leaves** alternate, heart-shaped, 2 to 6 inches (5 to 15 cm) long, smooth, with long petioles. **Flowers** funnel shaped, 2 to 3 inches (5 to 7.5 cm) in diameter, white with dark purple center. **Seed pod** egg-shaped, enclosed by several leaflike sepals, containing 2 to 4 seeds. **Seeds** dark brown, fringed with soft hairs. **Found** in cultivated fields, along fences and roadsides, especially on sandy soils. Most troublesome in corn, soybeans, and small grain crops. Also commonly known as wild sweet potato.



Skeletonleaf Bursage



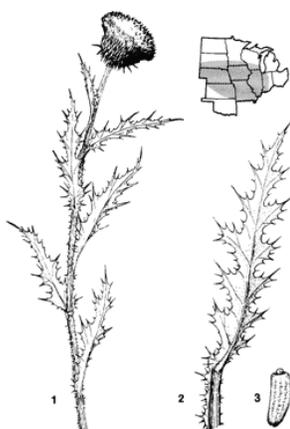
Russian Knapweed

**SKELTONLEAF BURSAGE**, *Ambrosia tomentosa* Nutt. **1**, top of plant; **2**, root system and young plant; **3**, male flowers; **4**, seed. **Perennial**, reproducing by seeds and deep creeping rhizomes. **Stems** bushy, branched, usually 1 to 2 feet (30 to 60 cm) tall. **Leaves** alternate, divided into narrow lobes, hairy on underside, 2 to 5 inches (5 to 12.5 cm) long. **Flowers** small, male and female borne separately but on the same plant. Male flowers in small drooping heads along tips of branches; female in axils of upper leaves. Burs surrounding female flowers bear 1 to 3 seeds, have sharp spines when mature. **Found** in moist cultivated fields, waste places, pastures, and irrigated areas, especially if poorly drained.

**WOOLLYLEAF BURSAGE**, *Ambrosia grayi* (A., Nels.) Shinnery. A species closely related to the above. **Leaves** covered with short woolly hairs on both surfaces, terminal lobe quite large. **Bur** has curved rather than straight spines.

**RUSSIAN KNAPWEED**, *Centaurea repens* L. **1**, stem and leaves; **2**, new shoots; **3**, seeds; **4**, root. **Perennial**, reproducing by seeds and rhizomes. **Roots** deep and extensive with new shoots coming from various depths. **Stems** 2 to 3 feet (60 to 90 cm) tall, very hairy, ridged, tough, and woody, branches numerous, tipped with flower heads. **Leaves** hairy; lower ones deeply indented, resembling those of dandelions; upper leaves short, narrow, and smooth-edged. **Flower heads** about 1 inch (2.5 cm) in diameter, composed of disk flowers only, which vary from white to light rose or light blue; each head surrounded by small, leafy bracts with smooth tips. **Seed** grayish or yellowish, smooth, about 1/8 inch (3 mm) long. **Found** in waste places or dry-land areas. Persists in cultivated fields when established.

COMPOSITE FAMILY, Compositae

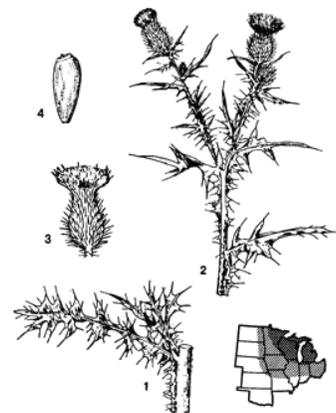


Musk Thistle



Canada Thistle

COMPOSITE FAMILY, Compositae



Bull Thistle

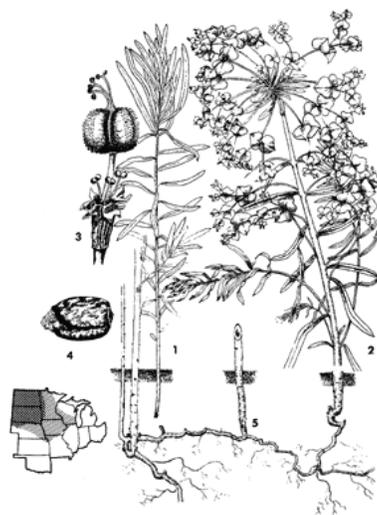
**MUSK THISTLE**, *Carduus nutans* L. **1**, upper part of stem; **2**, portion of stem showing leaf attachment; **3**, seed. **Biennial**, large, coarse plant. **Stem** erect, spiny, with spiny wings, 3 to 6 feet (0.9 to 1.8 m) tall, lower portion branched. **Stems** and branches densely covered with short hairs. **Leaves** alternate, coarsely toothed, extending down the stem, very spiny. **Flower heads** as much as 2 inches (5 cm) across, on the ends of long, nearly naked stems, frequently drooping or nodding; flowers purple or lavender; spiny-tipped bracts surrounding the head. **Seeds** about 3/16 inch (4.5 mm) long, glossy yellowish-brown; pappus hairlike. **Found** in pastures, meadows, and waste areas. Considerable variation may be found because this species is a polymorphic complex, with numerous semidistinct phases.

**CANADA THISTLE**, *Cirsium arvense* (L.) Scop. **1**, upper part of plant; **2**, seed; **3**, down with seed; **4**, new shoot; **5**, base of stem; **6**, root system. **Perennial**, reproducing by seeds and horizontal roots. **Roots** extend several feet deep and some distance horizontally. **Stems** 2 to 5 feet (0.6 to 1.5 m) tall, grooved, branching only at top, slightly hairy when young, increasingly hairy as they mature. **Leaves** usually with crinkled edges and spiny margins, somewhat lobed, and smooth. **Flower heads** numerous, compact, about 3/4 inch (1.9 cm) or less in diameter, of lavender disk flowers only. Surrounded by bracts without spiny tips. Male and female flowers usually in separate heads and borne on different plants. **Seed** brown, smooth-coated, slightly tapered, about 3/16 inch (4.5 mm) long and with a ridge around the blossom end. Seed attached to tannish down that is easily broken off. **Found** in all crops; a persistent and troublesome weed. While this description fits most Canada thistles, there are a number of varieties differing slightly in appearance.

**BULL THISTLE**, *Cirsium vulgare* (Savi) Tenore. **1**, portion of stem showing leaf attachments; **2**, upper portion of stem; **3**, flower head; **4**, seed. **Biennial**, reproducing by seed. In first year forms rosette with large fleshy taproot. **Stem** second year, 2 to 4 feet (0.6 to 1.2 m) tall, heavy, often branched, more or less hairy. **Leaves** deeply cut, spiny, green on both upper and lower surfaces despite presence of hair. Leaf bases running down stem to give stem winged appearance. Spines on lobes of leaves and stems. **Flower heads** compact, 1 to 2 inches (2.5 to 5 cm) in diameter, rose to reddish-purple; each head surrounded by spiny-tipped bracts. **Seeds** straw-colored, striped with brown, ridged around one end, tipped with an easily detached plumose pappus. **Found** in pastures, meadows, and other uncultivated land. Does not survive cultivation.

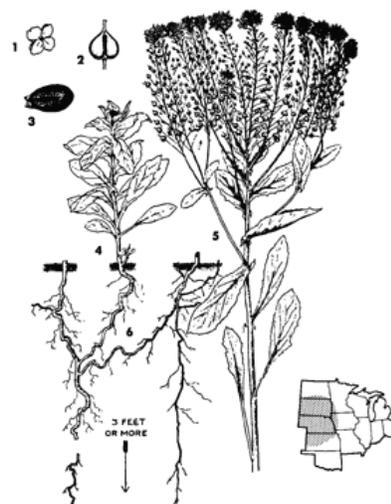
**TALL THISTLE**, *Cirsium altissimum* (L.) Spreng. Similar to above. **Biennial**, reproducing by seed. **Stems** 3 to 10 feet (0.9 to 3 m) tall. **Leaves** may vary from entire to lobed, and are dark green on upper surface and white woolly on lower surface. **Flower heads** about 1 inch (2.5 cm) in diameter, rose-purple.

SPURGE FAMILY, *Euphorbiaceae*



**Leafy Spurge**

MUSTARD FAMILY, *Cruciferae*



**Hoary Cress**

**LEAFY SPURGE**, *Euphorbia esula* L. **1**, leafy stem; **2**, top of stem with flowers; **3**, flower with seed pod; **4**, seed; **5**, root system. **Perennial**, reproducing from extensive rootstocks and seeds. **Roots** deep and spreading, woody, very persistent. **Stems** erect, smooth, branched at top, 1 to 2 feet (30 to 60 cm) tall, with milky juice. **Leaves** alternate on stems, narrowly strap-shaped, 1/4 inch (6 mm) wide, usually drooping. **Flowers** small, greenish, petals fused into a cuplike structure, borne just above the greenish-yellow heart-shaped floral bracts on top of stem. **Seed pods** on short stalks from the cuplike base, 3-lobed, with 3 seeds. **Seeds** smooth, light gray, with yellowish or white appendage attached to the tip. **Found** in pastures, waste areas, along roadsides, and in cultivated fields. A troublesome weed because of its spreading nature and persistence.

**HOARY CRESS**, *Cardaria draba* (L.) Desv. **1**, flower; **2**, mature pod; **3**, seed; **4**, new shoot; **5**, plant in bloom; **6**, root system. **Perennial**, reproducing by seeds and rootstocks. **Roots** deep, penetrating, slender, extending horizontally and vertically as much as 10 feet (3 m). **Stems** 1 to 1-1/2 feet (30 to 45 cm) tall, branching little except at top, covered with whitish hairs. **Leaves** on lower stem spatulate, tapering to a slender base; upper leaves sessile, clasping stem. Leaf margins wavy with shallow indentations. Leaves covered with whitish pubescence. **Flowers** white, 4 petaled, borne in flat-topped clusters. **Seed pods** 2-parted, heart-shaped, borne on racemes 2 to 4 inches (5 to 10 cm) long. **Seeds** oval, rough, about 1/16 inch (1.5 mm) long, reddish-brown, seed coat marked by many small netlike depressions. **Found** in dry areas, in all crops where established, especially pastures and meadows, and on sandy ridges. It is very persistent and hard to eradicate. There is another species of *Cardaria* similar to the above plant.



Wild Mustard



Field Pennycress

**WILD MUSTARD**, *Brassica kaber* (DC.) Wheeler. **1**, lower part of plant; **2**, upper part of plant; **3**, leaf from upper part of stem; **4**, flower cluster; **5**, seed pods; **6**, seed. **Annual** or **winter annual**, reproducing by seeds. **Stems** erect, branched near top, with a few bristly hairs. **Leaves**: lower ones irregularly lobed, toothed, with petioles and with bristly hairs; upper leaves smaller, often not lobed, alternate, with no petioles or short ones. **Flowers** conspicuous, with 4 yellow petals, in clusters at the ends of branches. **Seed pod** slender, on a spreading stalk; 1 inch (2.5 cm) or more long, about 1/3 of length being an angular beak at the tip. **Seeds** round, black, bluish, or brown, smooth and hard, about 1/16 inch (1.5 mm) in diameter. **Found** commonly in grain fields and occasionally in other cultivated crops. A troublesome weed in many areas. Seeds live in the soil for many years. Also commonly known as charlock.

**FIELD PENNYCRESS**, *Thlaspi arvense* L. **1**, seed; **2**, seed pod; **3**, upper part of plant; **4**, lower part of plant. **Annual** or **winter annual**, reproducing by seed. **Stems** erect, 4 to 20 inches (10 to 50 cm) tall, simple or sometimes branched above, smooth throughout. **Leaves** alternate, simple, toothed, 1/2 to 2 inches (1.3 to 5 cm) long, clasping stem with earlike projections. **Flowers** white with 4 petals, in racemes which lengthen greatly at maturity. **Seed pod** flat, circular, about 1/2 inch (1.3 cm) in diameter, 2 valved, broadly winged, with a deep, blunt notch at the top. Each pod contains several seeds. **Seed** dark reddish-brown to black, ovate in outline, flattened, about 1/16 inch (1.5 mm) long with about 10 curved, granular ridges on each side. **Found** in small grains, legumes, and noncultivated areas. This weed imparts a bitter, garlicky flavor and odor to milk.



Johnsongrass

Shattercane

**JOHNSONGRASS**, *Sorghum halepense* (L.) Pers. **1**, stout stem base, roots, and a young rhizome; **2**, panicle; **3**, group of spikelets; **4**, section of stem showing base of leaf; **5**, seed. **Perennial**, reproducing by large rhizomes and seeds. **Root** system freely branching, fibrous. Rhizomes stout, creeping, with purple spots, usually with scales at the nodes. **Stems** erect, stout, from 1-1/2 to 6 feet (0.45 to 1.8 m) or more tall. **Leaves** alternate, simple, smooth, 6 to 20 inches (15 to 50 cm) long, about 1/2 to 1-1/2 inches (1.3 to 3.8 cm) wide. **Panicles** large, purplish, hairy. **Seed** nearly 1/8 inch (3 mm) long, oval, reddish-brown, marked with fine lines on surface, bearing a conspicuous awn easily broken off. **Found** especially on rich soil. Troublesome in corn and soybeans on overflow bottoms. Difficult to control or eradicate. Listed as noxious weed in states where found.

**SHATTERCANE**, *Sorghum bicolor* (L.) Moench. **1**, upper portion of stem with panicle of racemes; **2**, group of spikelets. **Annual**, reproducing by seed. **Root** system fibrous. **Stems** erect, smooth, 4 to 8 feet (1.2 to 2.4 m) high; tillers readily produced from crown. **Leaves** resemble those of forage sorghum or sudan. **Seeds** resemble forage sorghum seed, enclosed in black to red, shiny glumes; seeds shatter very easily and remain viable in soil 2 to 3 years. **Found** only in cultivated fields, where it reseeds itself.



Downy Brome



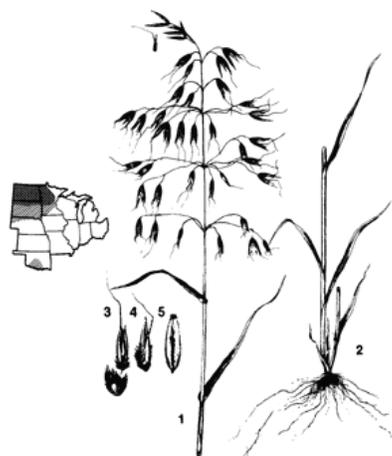
Japanese Brome and Cheat

**DOWNY BROME**, *Bromus tectorum* L. **1**, mature plant with fibrous root system; **2**, mature seed; **3**, panicle; **4**, spikelet. **Winter annual** or **annual** reproducing by seeds. **Stems** erect or spreading, slender, 6 to 24 inches (15 to 60 cm) high. **Leaves**, both blades and sheaths, light green, covered with long soft hairs. **Panicle** rather dense, soft, very drooping, often purplish, flowering in April-May. **Seeds** long and narrow, bearing long beard (1/2 to 3/4 inch; 12 to 19 mm), maturing in May-June. **Found** in meadows, pastures, small grain, wasteland.

**JAPANESE BROME**, *Bromus japonicus* Thunb. **1**, part of hairy stem; **2**, mature spikelet; **3**, seed, inner surface; **4**, distribution. **Winter annual** or **annual**, reproducing by seeds. **Stems** erect, 10 to 30 inches (25 to 75 cm) tall. **Leaves**, both blades and sheaths, covered with soft hairs. **Inflorescence** a panicle. Spikelets about 1/2 inch (13 mm) long, somewhat hairy, borne on long, drooping stalks. **Seeds** mature May-June, have a stiff beard 1/4 to 1/2 inch (6 to 13 mm) long, bend conspicuously outward at maturity. **Found** in grain fields, meadows, wasteland.

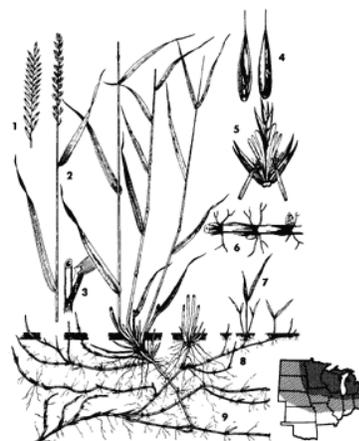
**CHEAT**, *Bromus secalinus* L. **5**, lower part of stem; **6**, panicle; **7**, mature spikelet; **8**, seed; **9**, distribution. **Winter annual** or **annual**, reproducing by seed. **Stems** erect, 12 to 24 inches (30 to 60 cm) high. **Leaves**, both blades and sheaths, smooth or slightly hairy. **Inflorescence** a panicle. Spikelets borne on shorter, more upright stalks than Japanese brome. **Seeds** bearing a short beard (1/8 to 1/4 inch; 3 to 6 mm), or none at all, broader and shorter than Japanese brome. **Found** in grain fields, meadows, and waste places.

GRASS FAMILY, Gramineae



Wild Oat

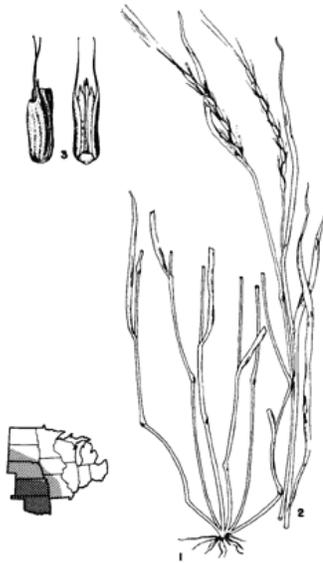
GRASS FAMILY, Gramineae



Quackgrass

**WILD OAT**, *Avena fatua* L. **1**, panicle; **2**, portion of lower stem, crown, and roots; **3, 4**, seeds with hull and enlargement of "sucker-mouth" base; **5**, kernel without hull. **Annual**, reproducing by seed. **Root system** extensive and fibrous. **Stems** smooth, stout, 1 to 4 feet (0.3 to 1.2 m) high. Leaves 3 to 8 inches (7.5 to 20 cm) long, resembling those of tame oats. **Panicle** usually more open than that of tame oats. **Spikelets** distinguished by long, dark awns, the lower parts twisted, the upper parts bent sharply at right angles to twisted parts. **Seeds** vary from white to yellow, brown, gray, or black; are usually hairy, especially near base. Distinguished from cultivated oats by the round "sucker-mouth" callus at base of the grain. **Seeds** usually ripen earlier than most cereals and many drop to ground before time to harvest cultivated cereals. **Found** especially in fields under continuous cropping to small grains and flax. Probably the most harmful annual weed in the hard red spring wheat area. Recently it has become a problem in the southern part of the hard red winter wheat area, where it acts as a winter.

**QUACKGRASS**, *Agropyron repens* (L.) Beauv. **1**, spike; **2**, stems, leaves, and inflorescence; **3**, auricle and ligule; **4**, seed; **5**, spikelets; **6**, buds on rhizome; **7**, new shoots; **8**, origin of new shoots; **9**, rhizomes and roots. **Perennial**, reproducing by seed and underground rhizomes. **Rhizomes** vary from 2 to 8 inches (5 to 20 cm) in depth, depending on soil type and soil treatment. Individual rhizomes live only two summers and one winter but new ones develop from buds in the axils of reduced leaves. Roots arise only at nodes. **Stems** 1-1/2 to 3 feet (45 to 90 cm) tall, with smooth culms and 3 to 6 joints. Leaves have auricles, ligule 1/32 inch (0.8 mm) long, hairy lower sheaths, upper sheaths smooth or nearly so. **Spike** has 3 to 7 short-awned florets in a spikelet. **Found** in open waste places, pastures, and most cropped areas. It requires special control methods because of its weedy habits. Although it is considered a primary noxious weed in most states, it can often be used for pasture or hay.



Jointed Goatgrass



Curly Dock

**JOINTED GOATGRASS**, *Aegilops cylindrica* Host. **1**, lower part of plant showing fibrous roots; **2**, upper portion with spike; **3**, seeds. **Winter annual**, reproducing by seeds. **Root** system fibrous. **Stems** erect, branching at base. **Leaves** alternate, simple, with auricles at the base of the blade, smooth or, in one variety, hairy. **Spikes** with spikelets arranged in a compact cylinder, bearded, longest beards at top of head. **Seeds** ripening ahead of wheat, shattering easily. **Found** principally in wheat fields, from which it spreads to roadsides and waste places. Very difficult to control where wheat is grown continuously

**CURLY DOCK**, *Rumex crispus* L. **1**, lower part of plant; **2**, upper part of plant; **3**, seed; **4**, distribution. **Perennial**, with large, yellow, somewhat branched taproot, reproducing by seed. **Stems** smooth, erect, 1 to 4 feet (0.3 to 1.2 m) tall, single or in groups from the root crown. **Leaves** mostly basal, smooth, 6 to 12 inches (15 to 30 cm) long, lanceolate, with wavycurled edges. Upper leaves alternate, the base of the short petiole having a papery sheath surrounding the stem. **Flowers** in dense clusters on branches at tip of stem, without petals, small, greenish, becoming reddish-brown at maturity. **Seeds** brown, shiny, triangular, and sharp edged, surrounded with 3 heart-shaped bracts with smooth edges. **Found** in pastures, roadsides, new hay fields, and waste areas.

**BROADLEAF DOCK**, *Rumex obtusifolius* L. **5**, seed; **6**, leaf; **7**, distribution. Similar to curly dock. Leaves broad and flat with a heart-shaped base. Bracts surrounding seed with toothed edges.

#### Below Not Shown

**WILD GARLIC**, *Allium vineale* L. **1**, flower cluster; **2**, old bulb and bulblets; **3**, underground bulblets; **4**, entire plant. **Perennial**, reproducing from seed, aerial bulblets, and underground bulblets. **Stems** 1 to 3 feet (30 to 90 cm) tall, smooth, and waxy. Leaves slender, hollow, nearly round, attached to lower half of stem. **Aerial bulblets** form in a cluster at top of stem, are oval and smooth with shiny covering. **Flowers** greenish white, small, on short stems above aerial bulblets. Seeds black, flat on one side, about 1/8 inch (3 mm) long; formed only occasionally. Found in grain fields and pastures; serious in the humid winter wheat area of the region.

**WILD ONION**, *Allium canadense* L. **5**, entire plant; **6**, flower cluster; **7**, old bulb. Similar to above species but does not produce underground bulblets. **Stems** 1 to 2 feet (30 to 60 cm) tall. **Leaves** flat, not hollow, arising from base of plant only. The old bulb coat of wild onion is fibrous-matted while in wild garlic it is thin and membranous. **Found** in same places as above.