LESSON OUTLINES FOR A STUDY OF WEEDS

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Introduction

It is not very easy to present definite figures in dollars and cents as to losses due to weeds. Few experimenters have taken the trouble to measure the losses induced by specific weeds or groups of weeds. It has generally been assumed that the loss was self evident. We have estimates by men who have worked with weeds and have given the matter much thought. We also have some measurements and observations on limited areas in our own state relating to losses from specific weeds.

In 1928 President Hoover invited the United States Chamber of Commerce to make a list of the important losses sustained by the American farmer. After a survey the Chamber submitted a list of 30 of the most important items of waste on farms, Erosion occupied first place and weeds second. The estimated loss due to erosion by the Department of Agriculture was $3,000,000,000 per annum. The United States Chamber of Commerce estimated the loss due to weeds to be $1,000,000,000 per annum. Mr. Boyles of the United States Chamber of Commerce said in 1929 in Chicago, "If I were to make an estimate now, I would place it at $2,000,000,000."

The following are instances of specific losses due to weeds in our own state: (1) A 40-acre field in Story county is covered with Canada thistle. In 1932 the owner paid $2.50 an acre to have the field fallowed all summer---total cost $100.00. No crop was harvested, the taxes were about $80.00 and the interest $170.00. This field will be farmed in 1933 according to recommendations by the Extension Botanist. (2) In 1930 about 700,000 pounds of sodium chlorate were used to destroy small areas of weeds at a cost for material of $84,000, and in 1931 nearly 600,000 pounds were used at a cost of $65,000. (3) A farm of 134 acres in Kossuth county was fallowed in 1932 because of thistles and quack grass. The cost of fallowing was $519.60, no crop was harvested, taxes were $205.43 and interest about $600. The farm is owned by an Insurance Company and will be farmed according to College recommendations in 1933.

The statements made above serve to illustrate the seriousness of the weed problem in an agricultural state like Iowa. It is important, therefore, that an effort be made to solve the weed problem. Successful methods of control are based on the application of certain fundamental principles including methods of reproduction, seed dissemination, storage of food reserves and the class to which a weed belongs, It is hoped that the following lessons will aid in a clearer understanding of weeds and their control.

LESSON I.

IMPORTANCE OF WEEDS

Object of Lesson: To show the relation of weeds to agriculture and to interest the student in a study of their habits.

Discussion Questions:

To Student	To Teacher
1. What is a weed?	1. It is a plant growing where someone desires to have other plants grow. 2. A weed is a plant out of place.
2. Are weeds ever beneficial?	1. Some have medicinal value. 2. Some have food value (ex. Levulose sugar from Jerusalum artichoke) 3. Cause cultivation of soil. Aids aeration and loose soil, absorbs water more readily.
3. How much corn (bu. per acre) would your father grow if he did not kill the weeds?	1. As low as 7 bushels over a period of years when the average was 47 in fields where weeds were held in check.
4. How do weeds cause this reduced yield?	1. Crowd out desirable crops. 2. Rob the plant of: a. Water b. Nutrient minerals. c. In some instances, sunlight.
5. In what other ways do weeds have injurious effects? a. Did you ever have the job of cutting weeds in corn after, or even before the crop was layed by? b. Did you ever help harvest weedy oats or wheat and have to sharpen the blades of the sickle bar because of weeds or even break some guard teeth? c. Did you ever have milk weeds gum up the separator in threshing and have to stop and clean it out? d. Do all seed grains and clovers sell for the same price? Why? e. If you were buying a farm and two farms were being considered, both with about the same fertility and improvements but one had several large patches of noxious weeds, the other was free of	1. Increase cost of production. a. Require extra labor in cultivation. b. Extra time required to harvest. c. Extra time and labor required to harvest. d. Weed seed reduce selling price of seeds of grain, clovers or alfalfa. For example, seeds or European morning glory in small grains, buckhorn, sour dock, sheep sorrel and Canada thistle in clover seeds reduce the value seriously. e. Weeds reduce selling value of the farm. A weed free farm is worth about $15.00 to $40.00 per acre more than a weed infested one if other factors are the same.

noxious weeds, which farm would you buy? Or how much less would you offer the man owning the weedy farm?

f. Did you ever see stock poisoned or otherwise injured by weeds? Give examples.

f. Some weeds are poisonous;
Examples:
Horsetail (Equisetum),
Loco weed
Poison hemlock,
Cowbane,
etc.

Weeds injurious to livestock:
a. Beards of squirrel tail grass irritate mouth of stock.
b. Needle grass awns act in the same way.

LESSON II.

DISSEMINATION OF WEEDS

Object of Lesson: To familiarize the students with the various methods by which weeds are scattered.

Discussion Questions:

To Student	To Teacher
In how many distinct ways may weeds reproduce?	1. Seeds. 2. Portion of plant. a. Stem joints take roots on plants such as old witch grass and quack grass. b. Portion of top may produce roots under favorable conditions. (Purslane). c. Some root fragments have the ability to send up shoots and make new plants. d. Rootstocks or rhizomes produce shoots and roots to form new plants. (Canada thistle, bindweed and many others).

SCATTERING OF PLANTS FROM SEEDS

How many different ways may seeds be scattered? List them.	1. Wind. 2. Water 3. Animals. 4. Explosive properties of the seed pod. 5. Man.
Using wind as a means of dissemination, how are weeds scattered? For example, the dandelion seeds have special parachutes to aid them. What other means can you list? Take first those with special adaptations.	Wind 1. Seeds with special adaptations: a. Parachutes of dandelion and milkweeds and thistles. b. Plumed seeds of cattails. c. Winged fruits or seeds, eg. maple, boxelder, linden and pine.
Seeds without speical adaptations:	2. Seeds without special modifications: a. Light seeds blown in dust particles on windy days. b. Carried by blowing leaves (Ex. wood sorrel, weeds are sticky and adhere to leaves). c. Whole plant is blown. (Ex. Iowa tumble weed, Russian thistle). d. Part of plants blown, (Ex. Old Witch grass.

In how many natural ways may weeds be spread by the aid of <u>water</u>?

1. Light seeds which wash in fields with heavy rains.
2. Part of plant washed in field (Ex. quack grass).
3. Whole plant may be washed down stream.
4. Heavy seeds drift under water surface.
5. Seeds with bladders, (Ex. Bladdernut; corky coverings (Milkweed) or air pockets (Sour dock).
6. Ice transportation, (Ex. seeds blown in water, frozen, and the spring that takes them down stream, often to flood some bottom land.

Seeds scattered by animals.
How many different ways can you list for livestock?

<u>Livestock</u>

1. Possess clinging spines--Cocklebur, burdock, burs, etc., which cling to tail, mane, foretop and fur of animals.
2. Fruits eaten by animals, seeds of many plants which have hard coverings may pass through the digestive tract uninjured and are scattered in the droppings.
3. Seeds may be carried on muddy feet of stock some distance before being dislodged.

Scattering of seeds by birds.

1. On muddy feet of water birds.
2. Small wet seeds adhere to feet and feathers.
3. Birds carrying seeds to eat them later. (Ex. Chickadee carrying sunflower seeds from winter feeding box, sticks them in crevice of bark to eat them. Some are dislodged which have not been eaten.

Insects scattering seeds.

1. Locusts eat some small seeds whole.
2. Ants carry seeds and some caterpillars carry them short distances. Some cannot be eaten and may germinate.

<u>EXPLOSIVE SEED PODS</u>

How many of you ever touched the ripe seed pods of either the tame or wild touch-me-nots? What happened?

1. Fruits of a few weeds have explosive properties. e.g. The explosion of mature seeds from common yellow field sorrel will carry them several feet. Touch-me-not pod. It breaks and quickly coils up to throw the seeds. The mature seed pods of leafy spurge throw their seeds 8 to 30 feet.

MAN AN AGENT OF WEED DISSEMINATION

How does a person scatter seeds? Name methods other than by burs, stick-tights, etc.

Clinging burs, burdock, sandburs, etc.

1. Planting impure seeds.
2. Not cleaning threshing machines, railway cars, trucks, etc.
3. Cultivating some weeds for ornamental purposes.
4. Cultivating some weeds for food.

LESSON III.

CLASSIFICATION OF WEEDS

Object of Lesson: To give an understanding of the life habits of the different classes of weeds and the general root characteristics of each class.

Discussion Questions:

To Student	To Teacher
1. Why is corn called an annual?	1. Corn matures in one year.
2. What are some other crop plants that mature in one year?	2. Oats, wheat, barley, etc. Note: Bring out the fact that these crops not only grow in one year but they mature seeds.
3. In your own words how would you define an annual plant?	3. Annual plants grow from seed to maturity in one year. The seed germinates in the spring or summer, The seedling grows, produces flowers and seeds and the plant dies in the fall.
4. What kind of root system has each of the crop plants listed as annuals?	4 and 5. Annuals have either small fibrous roots or a fleshy tap root somewhat branched. Some few annuals like crab grass, root from the nodes of the stem, during the current season. Note: For annual weeds, see Iowa Ext. Bulletin 171, Table 1, p.5.
5. List as many of the common weeds as you can which are annual in their habit. (Not over 20). From what you know of their root system do they have the same characters as those of the crop plants?	
6. Would you class winter wheat and winter rye as annuals? Why?	6. Winter wheat and rye are winter annuals.
7. How do they differ from true annuals?	7. They begin growth in the fall of one year and mature seeds the next summer.
8. What is a definition of a winter annual?	8. A winter annual is a plant, whose seeds germinate in the late summer or autumn the plants endure the winter, flower in the spring, produce seeds and perish in the summer. Some plants in this group may act as true annuals. Most of the winter annuals have taproots, but some, as in the grasses, have a fibrous root system. Some weed examples are: wild lettuce, wild barley or squirreltail, pepper grass, shepherd's purse, marsh cress.

9. Plants which require two crop seasons to produce seed, such as red clover and some strains of sweet clover are called biennials.
What does biennial mean? Look up derivation.

9. Bi= two
Annum= year.
The root system of biennials is usually a straight taproot, with a crown or rosette of leaves at the top during the first year.

10. List three or four examples of biennial weeds.

10. Burdock, wild parsnip, wild carrot, bull thistle, Iowa thistle, and white campion.

11. How long will alfalfa plants live and grow? Why is alfalfa able to live so much longer than any of the previous classes studied?

11. Up to 60 years or more. Because of inherent characteristics and a supply of reserve food stored in root and crown each year.

12. What type of root system would you expect in plants which live many years? Will they all be similar to the alfalfa root? Give reason for answer.

12. The root system of perennials is usually quite extensive, although quite varied. Some perennials have a deep wide-spread root system. (Ex. leafy spurge, hoary cress, etc.) Others have a deep root but not spreading (Ex. horse nettle) while still others like buckhorn and plantain have a clump of short shallow roots.

13. How many really bad weeds do you know which are perennials?

13. See noxious weeds in Iowa Extension Bulletin No. 171, and Circular 201.

Summarize different classes and root habits of each.

LESSON IV

PLANT FOODS AND FOOD RESERVES

Object of Lesson: To give an understanding of what plant foods are and the function they perform in the life of plants which live more than one year.

Discussion Questions:

To Student	To Teacher
1. What is a food?	1 to 4 - Have a general discussion about what constitutes a food and then bring out that although there is some difference of opinion, it is generally conceded that a food is any substance taken into a body or formed in a body which gives nourishing energy to the individual. Substances such as the chemical elements asked for in No. 4 are thought of as nutrient minerals and not foods at least for higher animals and plants since they do not give any energy to the plant or animal.
2. Is ordinary salt a food?	
3. Is water a food?	
4. Is lime a food to a plant which needs calcium?	
5. What are the elements of nature used by plants in their life processes. Are all of these foods?	5. Carbon, hydrogen, oxygen, nitrogen, sulphur, phosphorous, iron, calcium, magnesium, potassium, zinc and several others used in very small amounts as boron, iodine, chlorine, etc.
6. How are you going to class these substances; if they are not foods, what are they?	6. Some writers consider a food as any substance used by an organism for growth and well being, but for the sake of being consistent only those substances which are capable of liberating energy will be called foods.
7. Are sugar and starch foods? What plants contain large quantities of sugar and starch?	7. Sugar and starches are foods. Potato tubers, wheat, corn, sugar beet and sugar cane.
8. Can plants use sugar and starch to liberate energy?	8. They can be oxidized to liberate energy.
9. What other substances may be used as food for plants or animals? Can they all be used to liberate energy?	9. Other plant foods are proteins, fats and oils.
10. From what plants are oils extracted.	10. Corn, cottonseed, castor beans and soybeans.

11. What parts of plants are used for food by man?	11. Seeds, fruits, roots, tubers, etc.
12. Of what use is it to the plant to store the food in these places?	12. Reserve food for new growth either from the seed or other parts of the plant.
13. What parts of a plant other than the seeds and fruits have a large percent of plant food stored and why?	13. Roots and rootstocks as well as above ground portions of plants which remain alive, are used for food storage. This stored food is used for energy when the plant resumes growth. Bring out that the storage of plant food is similar to charging a storage-battery. Energy is present which may be used later when needed, thus biennial and perennial plants must store up food in order to start growth in the spring.

Part II. To give an understanding of where the plants get their foods.

To Student.	To Teacher
1. Where does sugar and starch come from in a plant?	1. Green plants are able in the presence of sunlight to combine water from the soil with carbon dioxide from the air to make simple plant sugars. These plant sugars are converted into starch and stored in this insoluble form.
2. Can all plants make food? A mushroom is a plant, does it make its own food? How is its food secured?	2. Only green plants, that is those containing the green pigment (Chlorophyl) can manufacture food. Mushrooms get their food from decaying organic matter. Such organisms are called saprophytes. See Botany Circulars 1-2-3-4 and 5, entitled "Some Activities of Plants.
3. What part of a plant is most active in food making?	3. The leaves are most active, but more specifically the cells just below the epidermis have most of the green material in them.
4. Could a plant be sealed up in a glass container with a liberal water supply and live a normal life? Why?	4. No, because no carbon dioxide would be available.
5. Why does the corn in a flooded section of a field die when water has stood on it for several weeks?	5. Death of the plants is due to a lack of oxygen for the roots. Oxygen is necessary for normal respiration.

LESSON V.

PERENNIAL WEEDS

Object of Lesson: To show the relation of perennial weed structure to principles and methods of control.

Discussion Questions:

To Student.	To Teacher
1. What is a perennial weed?	1. A perennial weed is a plant that is able to store food reserves and produce top growth from its roots each year.
2. Give 4 examples of perennial weeds (Look in Extension Bulletin 171)	2. Buckhorn, Canada Thistle, European morning glory, hedge bindweed, horse nettle, milk weed, etc.
3. How are perennials able to live from year to year?	3. By virtue of the stored food.
4. Where is the food stored?	4. In the parts which remain alive. For weeds, in roots and rootstocks.
5. What is the difference between a root and a rootstock?	5. There are several differences structurally but in general roots are absorbing organs and may branch at any point. Rootstocks are really underground stems with many stem characteristics and branching takes place only from the nodes.
6. Give 2 examples of weeds which have rootstocks?	6. Quack grass and Devil's shoestring. One sure way of determining a rootstock is that the underground parts have joints.
7. How deep do perennial weed roots penetrate the soil?	7. Some of those which penetrate to greater depths--leafy spurge, 15 feet; horse nettle, 8 feet; Devil's shoestring, 6-8 feet, European morning glory, 9 feet. Roots of buckhorn and red sorrel penetrate 8 to 12 inches.
8. Are the deeper rooted weeds any more difficult to eradicate than the shallower rooted ones?	8. Specific weeds vary in their ability to withstand being cut off several times but in general the deeper rooted ones are hardest to kill by using cultivation methods.

9. Make a list of 10 perennial weeds you consider the worst and give reasons as to why you consider them as such.

9. Canada Thistle, perennial sow thistle, quack grass, European morning glory, horse nettle, leafy spurge, perennial peppergrass, Russian knapweed, sheep sorrel, Devil's shoestring, milkweeds.

10. What is the outstanding principal involved in killing perennial weeds?

10. Prevention of food storage and exhaustion of organic food reserves in roots and rootstocks.

11. List some methods which could be used for the destruction of small or large areas of Canada Thistle, quack grass and European bindweed (Ext. Bulletin 171) (Three Bad Weeds of Iowa). Ext. Circular 201.

11. (1) Spraying with sodium chlorate.
(2) Frequent surface cultivation in soybeans, potatoes, or late planted corn.
(3) Pasturing with hogs and sheep. (Hedge bindweed).
(4) Seeding to alfalfa.
(See Bulletin 171 and Extension Circular 201.

LESSON VI.

PRINCIPLES AND METHODS OF WEED CONTROL

Object of Lesson: To lead to an understanding of the basic principles involved and the methods which may be used in the control or eradication of weeds.

Discussion Questions.

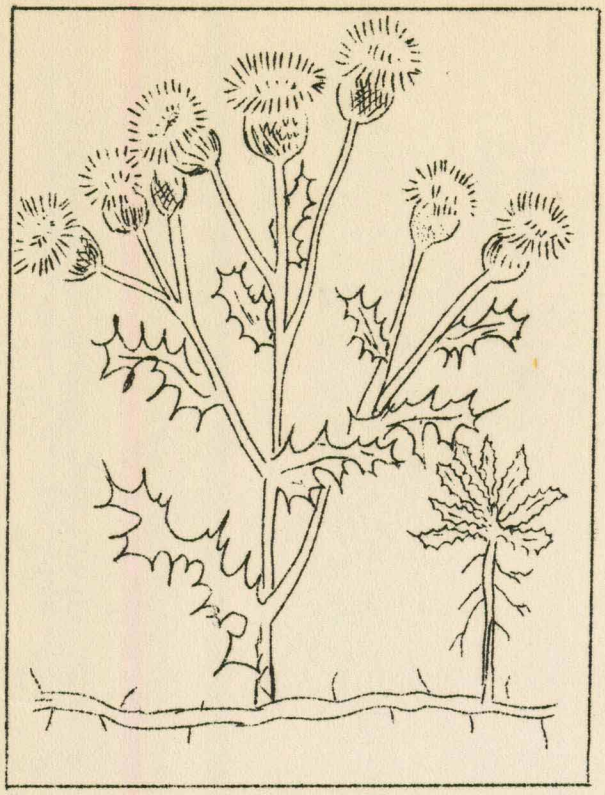
To Student.	To Teacher
1. What is a principle?	1. As used in this study it is a basic fact secured from knowledge of the behavior of weeds and from which a method of control may be developed.
2. What is meant by method?	2. A practice or system based on some fundamental fact which when put into operation will result in a changed condition or in the solution of a problem.
3. What are 8 important principles which it is desirable to know in order to control weeds?	3. a. Use only clean seed. b. Prevent weed seed production which destroys an important method of reproduction. c. Destroy weeds with mature seeds. d. Kill seedlings before they produce large plants. e. Do not allow food reserves to accumulate in the roots. Tops are essential in the manufacture of food. f. Destroy underground rootstocks of weeds whenever possible to prevent reproduction. g. Maintain or increase soil fertility. h. Have new or unknown weeds identified as soon as discovered.
4. List as many methods of controlling annuals and biennials as you can. Give reasons for suggesting them.	4. a. Buy only clean seed or produce clean seed by destroying weeds before seed crop is harvested. Use the fanning mill and have your seed tested. b. Practice a rotation system which involves clean cultivation, and growing of legumes for hay or pasture. c. Adopt a soil building program which puts organic matter and fertility into the soil so that crops can compete successfully with weeds.

d. Mow roadsides and pastures two or three times a year to prevent seed production.
e. Destroy seedlings by harrowing, blind plowing and fallowing.
f. Practice early fall plowing.

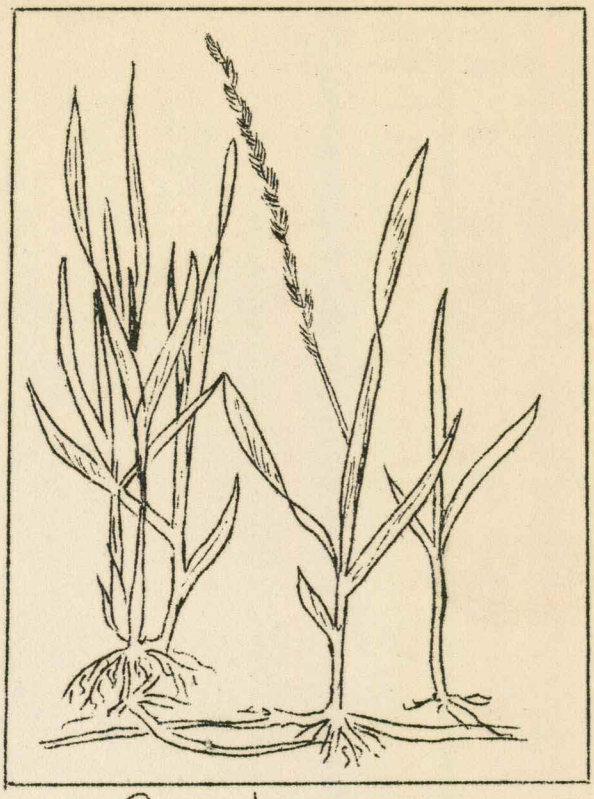
5. What methods may be used for perennials?
What does fallowing do?
Is it desirable to grow a crop on large areas infested with weeds?
Why can roots of perennials send up new shoots after one year of surface cultivation?

5. a. Summer fallow from June to August and sow alfalfa.
b. Summer fallow from June to September then sow winter rye. Fallow for two years, then sow alfalfa the third year.
c. Plow infested areas in late May then plant such row crops as soybeans, sorghum, potatoes and corn. Cultivate with a surface (duck foot) cultivator as soon as weeds come above the soil.
d. Summer fallow until July or August, then drill in millet or sorghum for hay or to be plowed under. Practice for two years then sow alfalfa in August.
e. Use a spring tooth harrow in July, August and September to comb out creeping roots. Rake and burn.
f. Treat infested areas with sodium chlorate either in dry or liquid form. (See Extension Circular 201-1934).

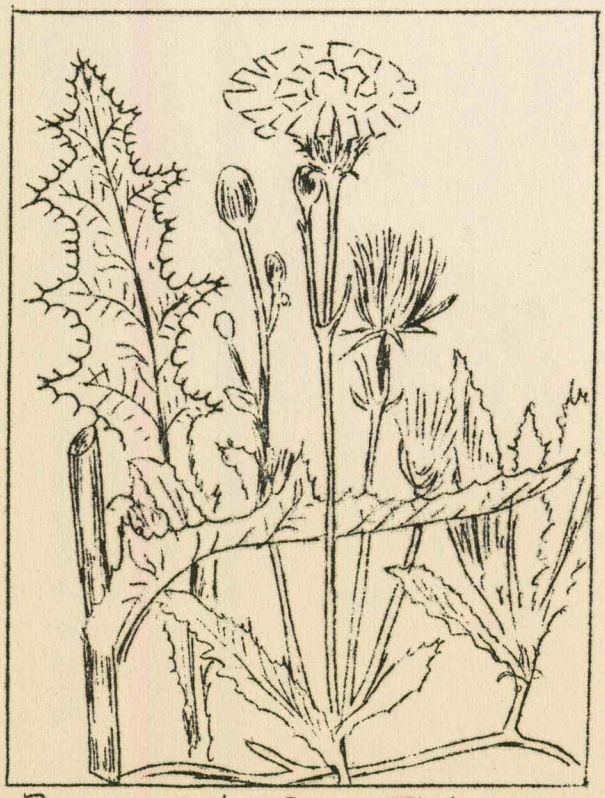
SOME WEEDS OF IOWA



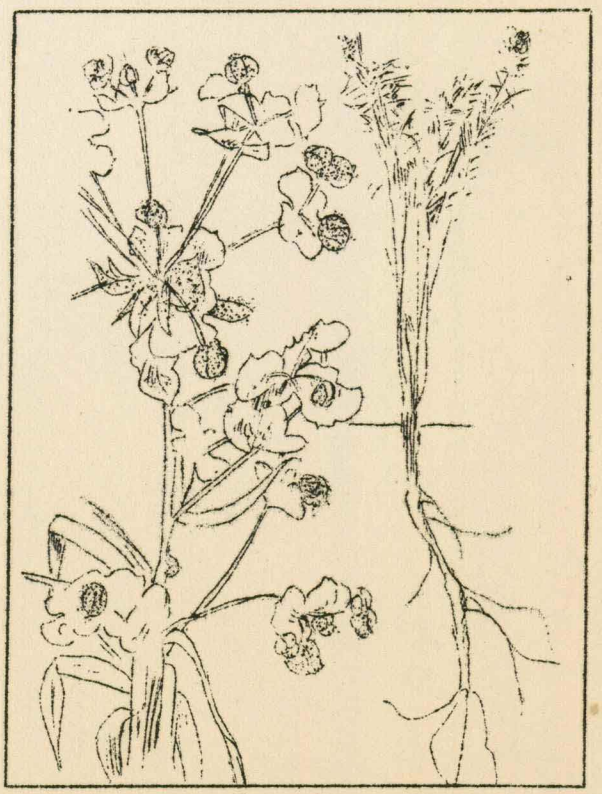
Canada Thistle



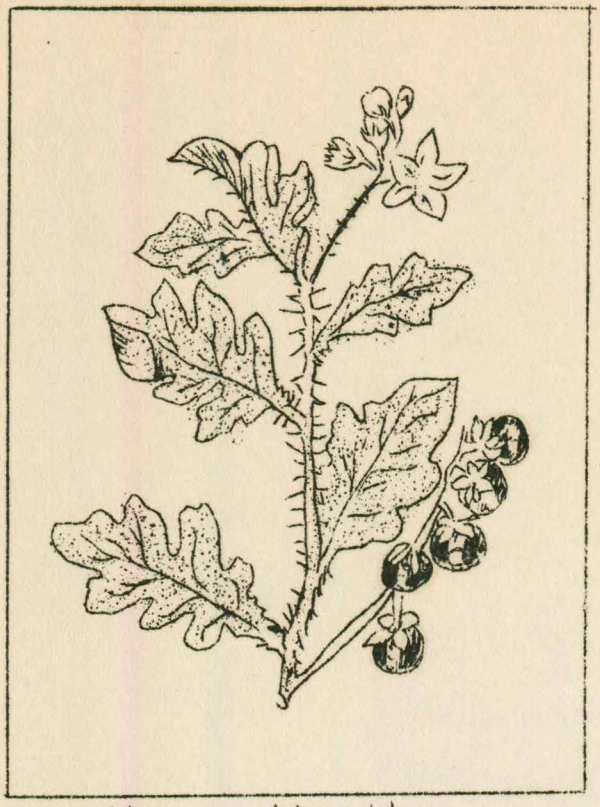
Quack grass



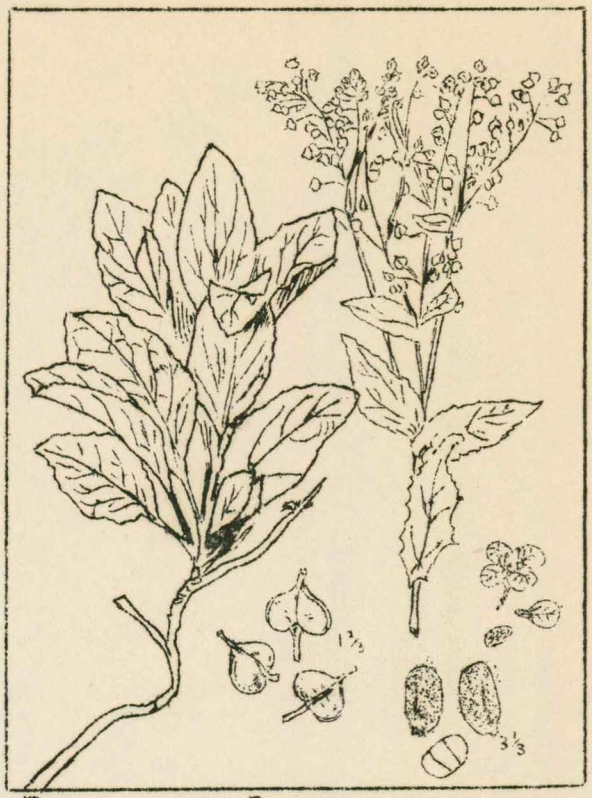
Perennial Sow Thistle



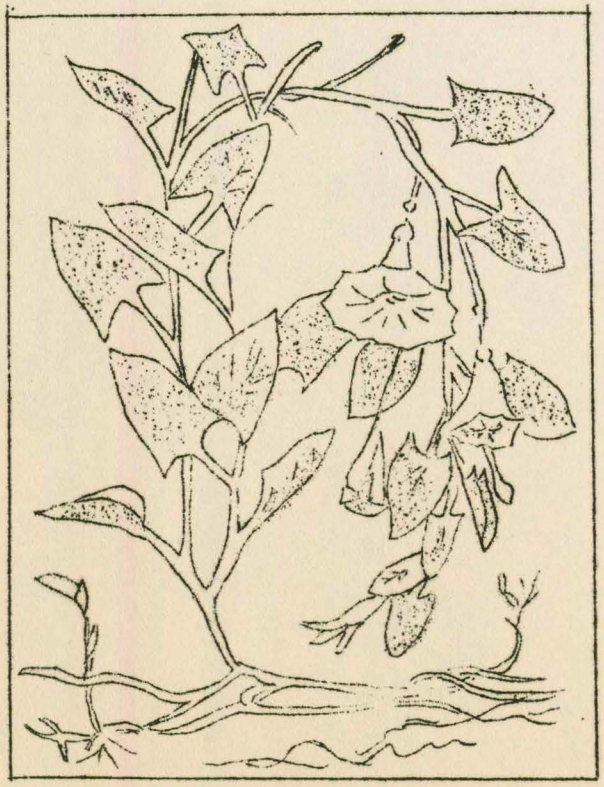
Leafy Spurge



Horse Nettle

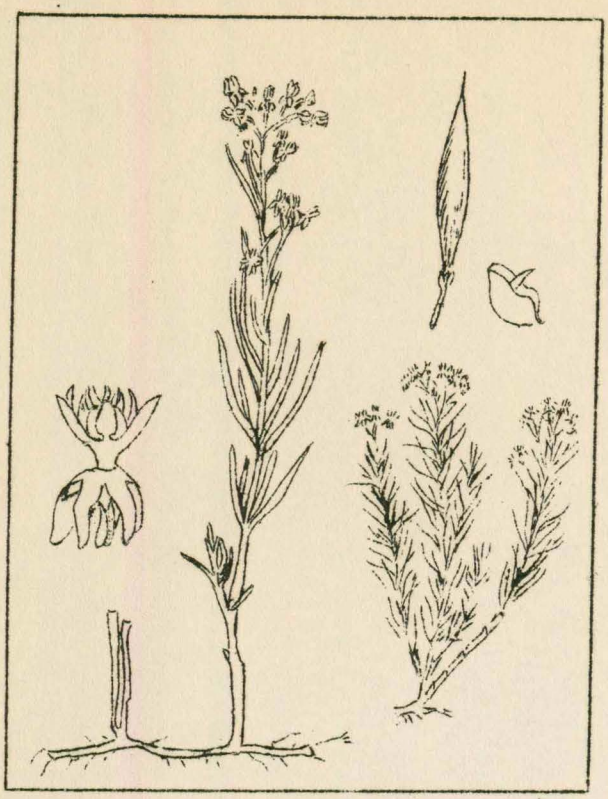


Perennial Pepper Grass

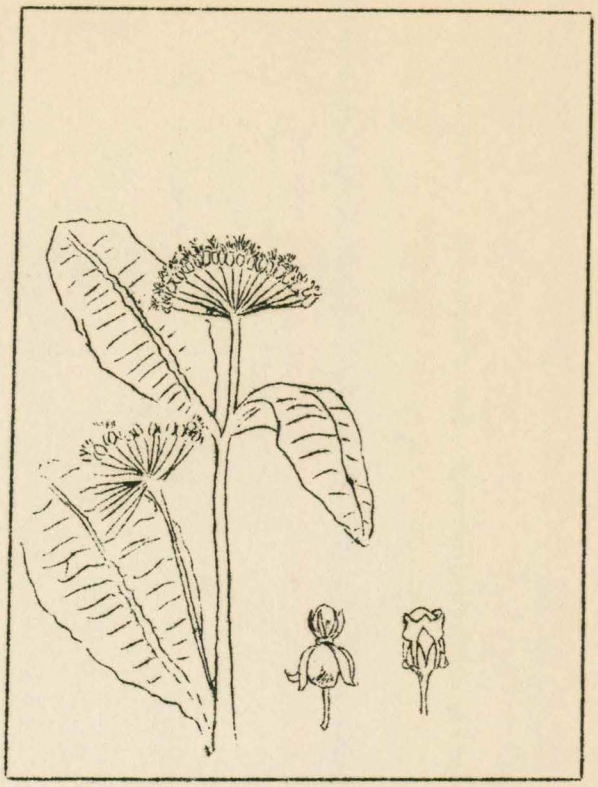


European Bindweed

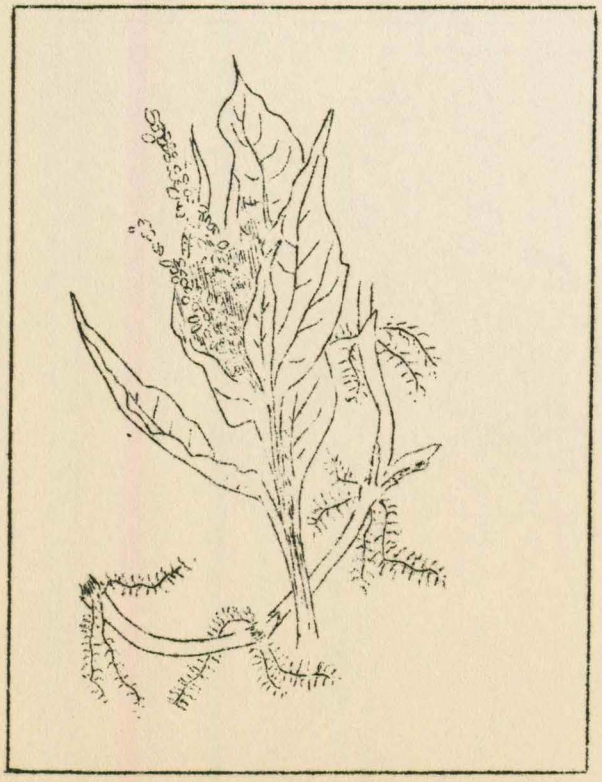
Russian Knapweed



Whorled Milkweed



Common Milkweed



Devil's shoe string

Sheep sorrel