

"Bulletin (Alaska Agricultural Experiment Stations (U.S.))"

LAWN WEEDS

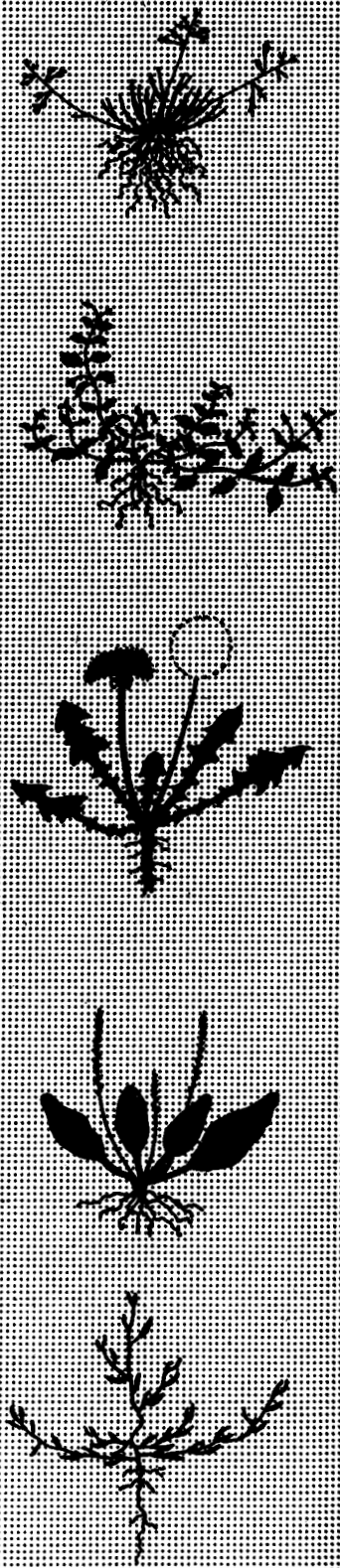
in Alaska

IDENTIFICATION

CONTROL



ALASKA
S
33
E2
no.34
c.2



L. J. KLEBESADEL, agronomist

RASMUSON LIBRARY

UNIVERSITY OF ALASKA-FAIRBANKS

University of Alaska

ALASKA AGRICULTURAL EXPERIMENT STATION

IN COOPERATION WITH

UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN 34
APRIL 1963

CONTENTS

Cultural practices combat weeds	3
Discourage weeds when preparing a new lawn	4
Kill weeds or replant?	5
Use of weed killers, equipment	7
Calibration of sprayers	9
Chemical names	9
Weed-killer terms	10
Plant descriptive terms	11
Calculating application rates	12
Tabular mixing guide	12
Precautions	13
Conversion information	13
How to use this bulletin	16
Weed identification and spot treatment	13
Field horsetail	14
Prostrate knotweed	15
Annual bluegrass	16
Quackgrass	18
Broadleaf plantain	20
Common chickweed	22
Yarrow	24
White clover	25
Shepherdspurse	26
Foxtail barley	28
Dandelion	30
Pineappleweed	31
Tabular summary of recommended herbicides	32

LAWN WEEDS IN ALASKA

Identification and Control

MANY different kinds of plants usually grow in close association with each other in nature. Woodlands, roadsides, mountain slopes, marshlands — almost all places not closely attended by man have their own complex plant associations. A lawn comprised of only one or a few grass species is an unnatural, artificial situation. Accordingly, lawns can be kept attractive only by diligent efforts to eliminate undesirable plants and to prevent the natural invasion of turfs by unwanted plants. This battle must be renewed each year. Knowledge of the habits and weaknesses of weeds enables the lawnkeeper to vanquish these foes in every encounter, usually with little expenditure of effort.

A lawn can consist of any plant cover the lawnkeeper chooses. However certain grasses, like Kentucky bluegrass, excel for turf because—

- Their vertical leaf blades are fine, uniform, and neatly attractive when kept mowed to 1½ or 2 inches in height
- They are able to spread underground to fill in bare areas
- They bind the soil against erosion
- They provide an excellent ground cover for children's play and other lawn activities
- They are perennial
- They remain green and attractive throughout the growing season
- They do not mature and produce seed heads when mowed as turf
- Seed is plentiful and fairly inexpensive

A weed is a plant growing where it is not wanted. Any plants that invade lawns and detract from the beauty or purpose of desirable grasses or which crowd out and replace the grass are lawn weeds. Unattractive and aggressive, most common Alaskan lawn weeds are also extremely prolific because they produce great numbers of mature seeds in a relatively short time. Many common lawn weeds produce seeds below the clipping height of lawn mowers. Weed seeds are easily scattered throughout the lawn by whirling mower blades, wind, and many other agents. Certain weeds like quackgrass and yarrow cannot produce seeds under close mowing but can spread and produce new plants from underground rootstocks called rhizomes.

Certain weed seeds possess appendages permitting them to be carried great distances by winds. Two examples are dandelion and foxtail barley. These are common in fencerows, abandoned yards and fields, roadsides, and other untended areas. Homeowners will always be plagued with new invasions of seeds from these sources.

An almost unbelievable number of tiny weed seeds are already buried in any soil on which weeds have grown in the past. They remain viable for many years. When brought to the surface during tillage where air, light, moisture and temperature conditions are favorable, many of these old seeds germinate and grow.

A few weed seeds are sometimes found in lawn seed, especially in cheapest kinds. However, this source of weed infestation is of minor importance compared to other sources. Soil amendments such as peat and manure often contain weed seeds.

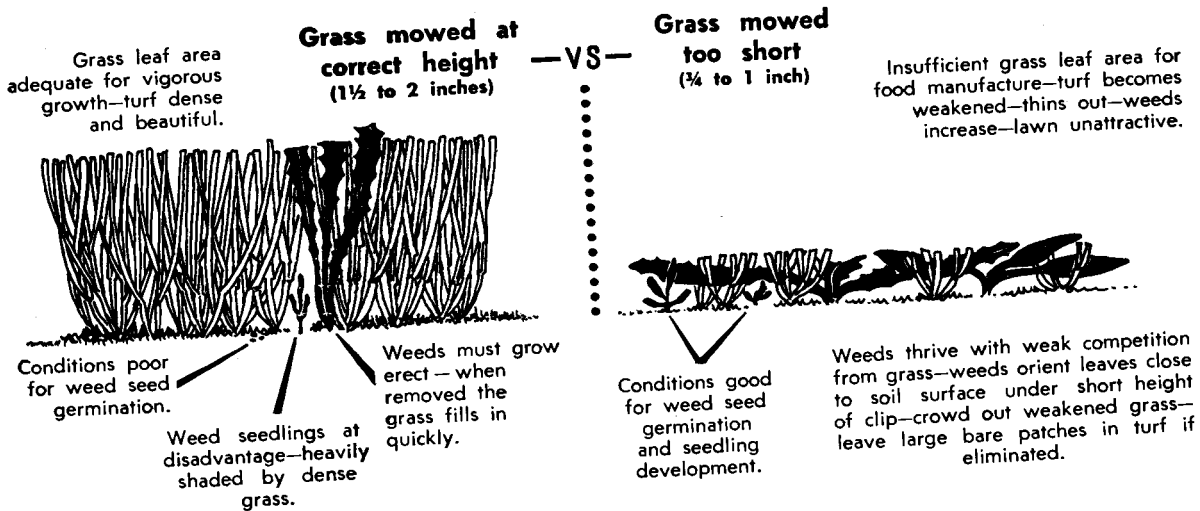
Most common weeds are extremely persistent. Until direct action is taken to eradicate them, weeds persist in lawns because they can adapt readily to the lawn environment. Many thrive under low soil fertility conditions—levels inadequate for vigorous growth of grasses.

Weeds are economically objectionable because property values are depressed by unattractive lawns. Home owners aware of this adopt good management practices to keep their lawns healthy, weedfree and attractive.

CULTURAL PRACTICES COMBAT WEEDS

A dense stand of vigorous grass is the best defense against weed ingress. Any practice that helps maintain a thick, healthy turf also combats weed invasion. Weeds are more often the result, rather than the cause, of a poor lawn. Grass vigor is promoted by adequate fertility and soil moisture. Clipping too short and excessive traffic damage turf and encourage weeds.

Height of clipping—Clipping lawns too short is undoubtedly the most common and least understood abuse of lawn grasses. **Do not clip your lawn shorter than 1½ to 2 inches.** Many well meaning lawnkeepers mistakenly adjust their lawn mower to cut as low as possible thinking



Effects on grass and weeds of mowing lawn at correct height versus too short.

that it will set back the weeds. Troublesome lawn weeds, however, can develop stem and leaf growth close to the soil surface and persist remarkably well where clipping is much too close for desirable lawn grasses to thrive (see sketch above). Desirable lawn grasses continue to grow erect regardless of height of cut. Therefore, clipping too close removes an excessive amount of food manufacturing tissue and causes grasses to deplete their energy reserves in order to put forth new leaf growth. Continued close mowing results in a gradual loss of vigor and starvation of the desirable grass.

Fertilizer—A good lawn grass must be productive, just as any other crop. It must continue to put forth new leaf growth throughout the season. Sufficient fertilizer, especially nitrogen, must be supplied at regular intervals. A general schedule for most lawns is—

Each spring: 10 to 12 pounds of 10-20-10 mixed with 4 to 5 pounds of ammonium nitrate (or their equivalent) per 1,000 square feet.

Mid summer: 5 pounds of ammonium nitrate (or its equivalent) per 1,000 square feet.

Influence of traffic—Excessive traffic causes injury to the leaves and crowns of lawn grass. In addition, an indirect but more disastrous effect is brought about by compaction of the soil. Desirable grasses will not thrive where the soil becomes hard-packed. Frequently used paths and

areas near doorsteps or under clotheslines are situations where excessive traffic is harmful and often lethal to lawn grasses. Certain weeds such as pineappleweed and knotweed can persist along paths, or doorsteps, and other hard-packed areas where lawn grasses cannot.

Trampling is detrimental to grasses at other times of year as well as when they are actively growing. Grasses are extremely susceptible to trampling in early spring just after frost has disappeared from the soil and the sod is soft and saturated. Packing of snow on paths used during winter or by vehicular traffic across the lawn often results in smothering of lawn grass. To eliminate excessive traffic on lawns discontinue frequent use of pathways or build a sidewalk. Stay off grass when sod is soft in early spring. Avoid excessive compaction of snow on lawns.

DISCOURAGE WEEDS WHEN PREPARING A NEW LAWN

Certain precautions taken at this time will minimize the weed problem both during lawn establishment and thereafter.

Use good, weed-free soil—A well drained, deep layer of silty topsoil that is free of weed seeds is ideal for a good lawn. Sandy or gravelly soil will not support a dense, vigorous grass turf which is the first line of defense against weed invasion. Steps that are especially helpful in preventing weed problems include—

- Establish grades with satisfactory drainage from all areas—eliminate any depressions that hold water, weaken grass, and allow weeds to invade.
- Select topsoil that doesn't contain weed seeds or quackgrass rootstocks—soil with a history of having supported weed growth will certainly contain many weed seeds. Quackgrass rootstocks (rhizomes) will resume growth and infest the lawn with quackgrass plants.
- Use sufficient topsoil over base material—provide at least a 6-inch layer of good topsoil. Weeds can thrive on poor soils but grass cannot.
- Incorporate sufficient fertilizer into topsoil before seeding.

Soil fumigation¹—This treatment, prior to seeding a new lawn, is effective in killing all living organisms in the soil including seeds, living plants, and rootstocks. However, unlike typical soil sterilants which normally prevent plant growth for a considerable period of time, soil fumigants dissipate rapidly, allowing fumigated soils to be seeded with lawn grasses one to three weeks after treatment. Because soil temperatures are relatively low in Alaska, recommendations supplied with fumigants for rate of application and time between treatment and seeding should be approximately doubled.

Prior to any fumigation treatment, the soil should be tilled to a depth of 6 inches. Two products, D M T T (3,dimethyltetrahydro-1,3,5,2-4 thiadiazine-2-thione) and SMDC (sodium N-methyl dithiocarbamate) are applied as liquid drenches. The drench should be followed immediately by a thorough sprinkling to soak the soil to about a 6-inch depth. These products are marketed under trade names such as Crag Mylone² (DMTT), Vapam³ and VPM Soil Fumigant⁴ (SMDC). **Follow all directions and take all precautions indicated by the manufacturer.**

Seed the best adapted grass—A winterhardy, dense, vigorous turf can be extremely effective in resisting weed invasion. Trials in Alaska have demonstrated repeatedly that Kentucky bluegrass excels in this respect. Creeping red fescue is usually slightly inferior to Kentucky bluegrass in winter hardiness but generally superior to other lawn grasses. Northern-grown seed of these grasses is preferred to southern-grown supplies

for use in Alaska. Lawn grass seed mixtures not adapted to Alaska, and marketed in brightly colored packages with extravagant claims of performance, are common on retailers' shelves. Unadapted grasses usually winterkill seriously and open the lawn to weed invasion.

Care during establishment—Apply water to keep soil surface moist until the grass is at least one inch tall. Frequent, light sprinklings are best at this time. Avoid traffic over the new lawn. Grass seedlings are delicate. Do not mow grass until it is about 3 inches tall.

Do not use chemical weed killers on newly seeded lawns. Weed control measures in the new lawn can be started when the grass seedlings reach a 3-inch height although the grass seedlings are more susceptible to damage from chemicals even then than they will be later. Use the lightest rate of application recommended. Weed seedlings are more easily killed than mature weeds. Be careful not to exceed recommended rates of chemical weed killers at this time—it is easier to spray again than to have to reseed a lawn that has been killed by an overdose of weed spray.

KILL WEEDS OR REPLANT?

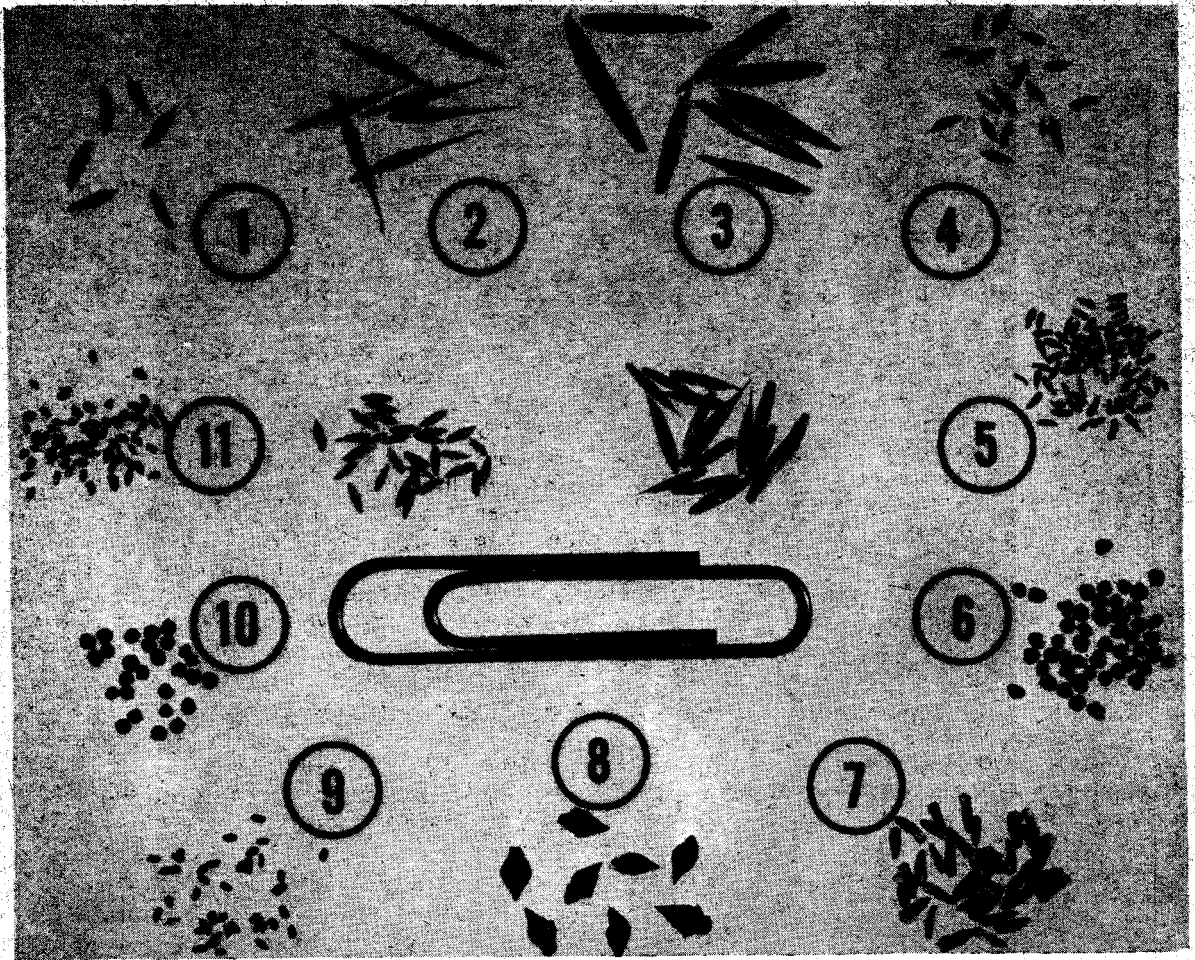
Several factors should be considered before a decision is reached on whether to improve an unattractive, weedy lawn or to prepare a new lawn.

General considerations—Certain basic features must be possessed by the weedy lawn if it is to be made into a good lawn simply by eliminating the weeds present. Some of these requirements are:

- Suitable overall drainage with at least a slight slope away from the house.
- Soil of good quality, free of stones and excessive debris.
- Freedom from heavy infestations of such weeds as quackgrass and foxtail barley that are difficult to eliminate from lawns.
- No hard-packed areas, such as well established paths, driveways or vehicle parking areas.
- A reasonably uniform stand of desirable grass.

Consideration of these points may help you decide if preparation of a new lawn is required or if the lawn is basically good and requires only that weeds be eradicated. It is rather pointless to expend effort to eradicate weeds if the lawn possesses major defects that can best be eliminated by regrading and preparing a new lawn.

¹ This section contributed by D. H. Dinkel, Horticulturist.
² Union Carbide Chemicals Co., Div. of Union Carbide Corp., 270 Park Ave., New York 17, N.Y.
³ Stauffer Chemical Co., 380 Madison Ave., New York 17, N.Y.
⁴ E. I. duPont-de-Nemours & Co., Inc., Grasseil Chemicals Dept., 1007 Market St., Wilmington 98, Delaware.



Comparative size and appearance of common Alaskan lawn weed seeds. For comparison, seeds of two common lawn grasses are shown at center above paper clip, left—Kentucky bluegrass, right—creeping red fescue. Weed seeds by number in photo above are:

- | | |
|----------------------------------|------------------------|
| 1. Dandelion (pappus removed) | 7. Yarrow |
| 2. Foxtail barley (awns removed) | 8. Knotweed |
| 3. Quackgrass | 9. Shepherdspurse |
| 4. Annual bluegrass | 10. Common chickweed |
| 5. Pineappleweed | 11. Broadleaf plantain |
| 6. White clover | |

Although preparing an entirely new lawn may be preferable in many instances, this alternative requires some expense, is often laborious, demands special care during establishment, and causes considerable disruption about the home. Moreover, preparing a new lawn often does not completely solve a weed problem—it usually only exchanges an established stand of weeds for a new crop of them.

Corrective measures—Many minor defects in a lawn that favor weed invasion can and should be eliminated with proper corrective measures. Vigorous raking will remove exposed stones and trash. Depressions that hold water in summer and ice in winter result in weakening or killing of the grass followed by weed invasion. Spade up such depressions and bring them up to desired grade with added topsoil. Incorporate fertilizer

into the soil, and either sow grass seed on them or grass them over with weed-free pieces of grass sod. Paths can be eliminated in the same manner. In either case, apply water frequently after correction and keep traffic off these areas until a firm, healthy sod has developed. These corrective measures, undertaken in conjunction with chemical eradication of weed infestations, will vastly improve the appearance of an unsightly lawn.

EFFECTIVE USE OF WEED KILLERS

Chemical weed control is an important tool in maintaining an attractive lawn but it cannot do the entire job alone. The use of chemical weed killers can only improve the appearance of a lawn to the extent that weeds are eradicated. The use of weed killers alone cannot make a beautiful lawn out of a lawn that is uneven, low in fertility, mowed too short, or otherwise poorly managed. In fact, elimination of weeds from a lawn that is comprised mostly of weeds will only serve to expose bare soil. A lawn of this type should be worked up and reseeded.

Weed killers are available in several forms. Liquid formulations and wettable powders are mixed with water and applied as solutions. Some weed killers are also available in dry, granular form and are applied with a lawn-type fertilizer spreader. Dust formulations in shaker canisters can be purchased also. Some weed killers are impregnated into wax bars that can be dragged over the lawn or rubbed on unwanted plants.

Application of weed killers in water solution is the most popular method. Dry formulations act more slowly and are usually not as predictable in effect as liquid formulations.

Two basic ways of applying chemicals to control weeds are, (a) uniform overall application and (b) spot treatment.

Overall application—This method is used when a weed infestation is generally present throughout the lawn and the entire area is to be sprayed. Calibration of delivery rate of equipment is necessary with this method. Tables 2 and 3 provide the necessary information for selection of the proper weed killer and preparation of weed killer solution in proper strength.

Spot treatment—This method is used when weeds are present only as scattered light infestations where individual plants or small patches require

Herbicides, like other household chemicals, should be stored in a safe place, out of reach of children. DNBP (dinitro) is poisonous to warm-blooded animals although it usually is not hazardous after it has been applied to lawns. As a safety measure, however, children and pets should be kept off sprayed areas until after lawn has been watered or rained upon. (Don't apply water until the day after treatment.)

Wear rubber gloves when handling herbicides. DNBP will cause yellow staining if it contacts shoes, clothing, or skin. Wash from skin immediately. Yellow stain that remains will last for a day or two. Stains on clothing come out in the wash if laundered promptly.

Don't spray on windy days. Fine mist droplets drift easily and can be deadly to susceptible ornamentals. Don't spray on rainy days. Rain-fall shortly after application of weed killers often reduces their effectiveness.

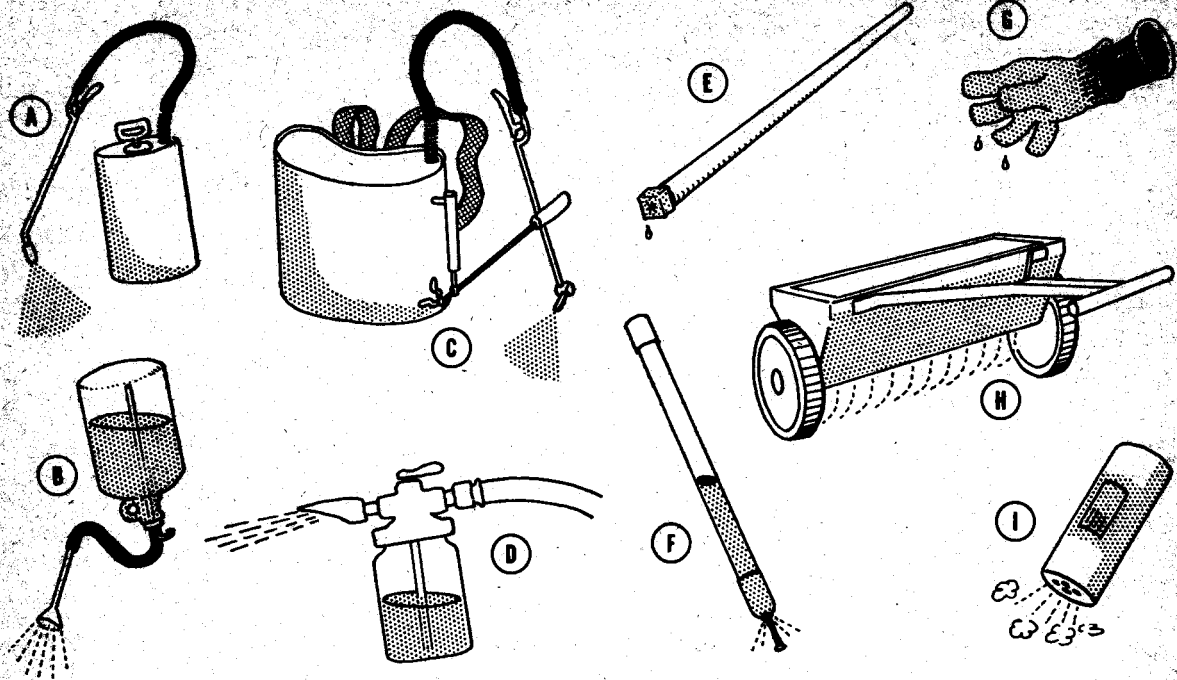
eradication. Procedures for spot-treatment control follow the description accompanying each weed illustration.

Successful weed control with chemicals regardless of application method, is dependent upon the following simple steps:

- Identify correctly the weeds to be eradicated.
- Select the weed-killing chemical or chemicals that will be effective on the weeds to be killed.
- Choose an appropriate method of application for your weed problem. Light infestations of weeds can be eliminated by simple **spot treatment**.
Calibrate the sprayer or spreader to be used if **overall application** method is chosen.
- Apply chemical weed killers in strength sufficient to eradicate weeds but not so strong that grass is injured nor so carelessly that nearby ornamentals are damaged.

EQUIPMENT FOR APPLYING WEED KILLERS

Following are illustrations and descriptions of different types of equipment for applying weed killers. Most can be purchased at hardware or garden-supply stores and some can be constructed at home.



For dispensing liquids—

A. Compressed-air tank sprayer—This is perhaps the most commonly used device for applying liquid weed killers. Available in many sizes, those with one to three gallon capacity are easy to carry and adequate for most lawns.

B. Gravity-flow sprayer—This sprayer is less expensive than the above type. The coarser droplets delivered under low pressure permit less opportunity for drift of spray than can occur with the finer spray from compressed-air sprayers. This sprayer consists of a large jug, a cap or stopper, a breather pipe, and a delivery tube and nozzle. These can be purchased as a unit or constructed from parts.

A sprinkling can is somewhat similar to the above in operation but is much less satisfactory because the larger holes in the nozzle allow the solution to be dispensed too rapidly.

C. Knapsack sprayer—This type of sprayer utilizes a piston-type pump which is operated continuously while spraying to supply an even pressure in the tank. Although very satisfactory in operation, this sprayer is more expensive than the others described.

D. Garden hose sprayer attachment—This device, consisting of a spray nozzle and a jar, attaches onto a garden hose. A concentrated solution of weed killer in the jar is diluted as it is drawn into the water stream that passes through the sprayer from the garden hose. Follow directions for spray dilution supplied with the apparatus.

E. Sponge on a stick—This simple applicator for treatment of individual weeds is easily constructed by tacking a small piece of kitchen sponge to the end of a stick or broom handle. Dip the sponge into the herbicide solution and press the moist sponge lightly onto the center of each plant to be killed. This spot-treatment technique is especially useful for applying 2,4-D to dandelions and plantain. Weeds growing close to ornamentals can be treated if care is taken to avoid touching desirable foliage with the moist sponge.

F. Cane-type applicator—This device is somewhat similar in operation to the sponge-on-stick method. However, this apparatus possesses a small reservoir for holding a supply of weed-killer solution that is dispensed in minute quantities each time the base of the cane is pressed against a weed.

G. Cotton glove over rubber glove—Don a rubber glove on one hand and over that pull a cotton glove. Dip the gloved hand into the weed-killer solution and apply to weeds by stroking so that leaves are drawn between thumb and fingers of the moistened glove. Avoid moistening the leaves of desirable lawn grasses. This technique is useful in applying a dalapon solution to quackgrass.

For dispensing dry formulations—

H. Granule spreader — A lawn-type fertilizer spreader can be used to apply granular formulations of weed killers. Calibration of spreader should be done according to directions furnished with spreader for calibrating fertilizer delivery. Check accuracy of calibration on a small area before treating the entire lawn.

CALIBRATION OF SPRAYERS

When used to apply weed killers as an overall spray to a large area, sprayers A, B, and C described in the preceding section must be calibrated to determine their rate of output of liquid. This must be known in order to judge correctly how much herbicidal concentrate to add to a given amount of water in the sprayer.

Follow these steps to determine the rate-of-delivery of liquid from sprayers:

1. Stretch two parallel 50-foot lengths of heavy string 5 feet apart across your lawn. The area between the strings will be 250 square feet.
2. Pour a measured amount of water into the sprayer—3 gallons, for example.
3. Spray the measured area described above evenly with enough water to wet the grass leaves but not so heavily that water runs off. Walk slowly along a line midway between the strings while slowly and continuously moving the sprayer nozzle from side-to-side to spray uniformly the entire area between the strings. Spray this area 3 more times to have sprayed a total area of 1,000 square feet. Most herbicide dosage recommendations are per 1,000 square feet of lawn.
4. Measure the water left in the sprayer. Subtract this volume from the original amount in the sprayer to calculate how much was used to spray 1,000 square feet. For example, three gallons at start, minus 1 gallon left in sprayer equals 2 gallons to spray 1,000 square feet.

Knowing the rate of liquid delivery of the sprayer, it is then quite simple to calculate how much chemical to add to each gallon of water to prepare weed killer-water mixture for spraying.

I. Shaker cannister—Some weed killers are available in dust formulations packaged in shaker cannisters. These formulations are applied directly to weeds from the shaker cannister which serves as the applicator.

Care of equipment—Rinse spray equipment and measuring utensils thoroughly after each use. Some weed-killer residues are corrosive to equipment. Light oiling of movable parts is advisable. **Do not use measuring utensils for other purposes.**

Lawn fertilizer spreaders used to apply granular weed killers should be rinsed thoroughly with water, dried, and wiped with a lightly oiled cloth before storage. Never store spreaders with granular material left in the hopper.

If the recommended rate of weed-killer application is 3 teaspoons per 1,000 square feet and your sprayer applies 2 gallons of liquid per 1,000 square feet, add 3 teaspoons of weed killer for each 2 gallons of water to be used. Remember to spray the lawn at the same rate of travel, and about the same sprayer pressure, that were used to calibrate the sprayer.

If the lawn to be sprayed is large and difficulty will be experienced in spraying it evenly without missing some areas and possibly applying a double application in others, use the parallel strings to mark off strips 5 feet wide to spray. Each time a strip is sprayed across the lawn, move one string to 5 feet beyond the other to mark off another unsprayed 5-foot strip.

WHAT'S IN A CHEMICAL NAME?

There is a somewhat universal tendency for the non-chemist to recoil at the seemingly complicated names of many chemicals such as those listed in the following table in the column titled "chemical name". These names, however, are a surprisingly concise shorthand used by chemists to describe the extremely complicated molecular structures of chemicals that have been found to be effective as weed killers.

More simplified, abbreviated designations, or, in some cases, common names have been adopted for these compounds as listed in the first column of the table. Many manufacturers, in addition, apply their own trade names to their products. A few examples are listed in the second column of the table.

Table 1. Common names, trade names, and chemical names of several herbicides useful in combating common lawn weeds.

Common name	Trade names	Chemical name of herbicidal active ingredient
2,4-D	numerous	2,4-dichlorophenoxyacetic acid
2,4,5-T	numerous	2,4,5-trichlorophenoxyacetic acid
silvex or 2,4,5-TP	Union ¹ , Weedone	2-(2,4,5-trichlorophenoxy) propionic acid
2,4-DB ²	Butyrac 118 ³	4-(2,4-dichlorophenoxy) butyric acid
MCPA	numerous	2-methyl-4-chlorophenoxyacetic acid
dalapon	Dowpon ⁴	2,2-dichloropropionic acid
2-(MCP) ⁵	Compitox ⁴	2-(2-methyl-4-chlorophenoxy) propionic acid
dicamba	Banvel D ⁶	2-methoxy-3,6-dichlorobenzoic acid
DNBP or dinitro	Emerge ¹ , Sinox PE ¹	4,6-dinitro-ortho-sec-butylphenol

¹ Dow Chemical Co., Midland, Mich.

² Amchem Products, Ambler, Pa.

³ Similar in many respects to ordinary 2,4-D except that white clover is susceptible to 2,4-D and unaffected by recommended rates of 2,4-DB.

⁴ May and Baker (Canada) Ltd., 180 Bellarmin St., Montreal 11, Que.

⁵ Velsicol Chemical Co., 830 E. Grand Ave., Chicago 11, Ill.

⁶ Niagara Chemical Div., Food Machinery & Chemical Corp., 100 Niagara St., Middleport, N.Y.

DEFINING SOME WEED-KILLER TERMS

HERBICIDE means "plant killer" and is the term commonly used to refer to chemical formulations in liquid, powder or granular form that are specifically prepared for destroying weeds.

HERBICIDAL CONCENTRATE is the actual commercial preparation of an herbicide as purchased. An herbicidal concentrate, as expressed by its label, contains certain specified quantities of "inert ingredients" and "active ingredients". Inert ingredients are of no concern to the lawnkeeper in controlling weeds.

ACTIVE INGREDIENTS are the chemically active constituents in an herbicidal concentrate that kill weeds. Application of the correct amount of this portion of an herbicidal concentrate is the vital key to effective weed control.

ACID EQUIVALENT is a term encountered on labels of such herbicides as 2,4-D; 2,4-DB; 2,4,5-T; silvex; MCPA; 2-(MCP); dicamba and others to describe their concentrations on the basis of weight of active ingredient per unit volume. One preparation of 2,4-D may contain 2 pounds of "acid equivalent" per gallon while another, twice as concentrated, contains 4 pounds of "acid equi-

valent" per gallon. For purposes of weed control in lawns, the terms "acid equivalent" and "active ingredient" are synonymous. For example, an herbicidal preparation which is labeled to contain "4 pounds of acid equivalent per gallon" can be considered to contain 4 pounds of "active ingredient" per gallon.

CONTACT weed killers destroy plants merely by making contact with the foliage. DNBP is an example of this type of herbicide.

SYSTEMIC or **HORMONE**-type weed killers have a more complicated mode of action. They are absorbed into the plant's tissues and distributed throughout the plant where they upset the normal plant chemistry. 2,4-D is an example of a systemic herbicide.

SOIL STERILANTS are compounds that kill all plant growth when applied to the soil. Soil sterilization may be temporary or relatively permanent depending on the sterilant used and rate of application. Use of a soil sterilant may be desirable in an area adjacent to a lawn such as on a gravel driveway or parking area. **CAUTION**—Do not apply soil sterilants where runoff from rain or lawn sprinkler will carry sterilant in solution onto the lawn or to the roots of desirable trees or ornamentals.

SPRAY DRIFT is the movement through the air of fine droplets of mist from a sprayer. Spray drift can cause spray to reach and injure or kill desirable plants some distance from where spray is actually applied. Minimize spray drift by spraying on calm days and by using spray nozzles that apply coarse droplets of spray.

VOLATILITY is the characteristic of certain formulations of herbicides whereby gaseous vapors arise from the liquid on exposure to air at ordinary temperatures. These vapors can be injurious to susceptible ornamentals and garden plants. "Ester" formulations of 2,4-D are highly volatile and should not be used for weed control in lawns. Avoid volatility damage from 2,4-D by using low-volatility "salt" formulations such as 2,4-D "amine".

SELECTIVE weed control refers to the differential response of plants to herbicides whereby some types of plants escape injury from a given chemical while other plants are killed by it. (Examples: 2,4-D selectively kills dandelion and plantain at certain rates without causing injury to grasses. White clover is undamaged by 2,4-DB at rates that kill dandelion.)

Selective response of plants to herbicides depends upon rate of application of the chemical. A hypothetical but typical response: At very low rates of herbicide X, plants A and B both escape injury; at a selective rate of application, herbicide X kills plant A while B is uninjured; at still higher rates, X kills both A and B. This illustrates why application rates must be calculated carefully and the herbicide applied uniformly and at the proper rate to insure good selecting weed control.

SOME TERMS USED TO DESCRIBE PLANTS

Life span

Annual—A plant that lives for one growing season.

Winter annual—A plant that can function as an annual but which, when it starts growth during the latter half of one season, lives over winter and blooms, produces seed, and dies during the following spring or early summer.

Biennial—A plant that normally completes its life cycle and dies in its second year of growth.

Perennial—A plant that lives more than two years.

Plant parts

Awns—Bristly, hairlike outgrowths from structures in the seed heads of grasses.

Boot—The sheath of the uppermost leaf in grasses from which the seed head emerges to become visible.

Crown—The base of a plant at the surface of the ground.

Foliage—The leaves of plants.

Leaf arrangement—**Alternate**, leaves occurring individually along the stem; successive leaves on alternate sides of the stem. Example; knotweed. **Opposite**, leaves occurring in pairs on opposite sides of the stem at the same location. Example; chickweed.

Leaf blade—The elongated, narrow, flat portion of a grass leaf which is attached to the stem but extends away from it and terminates in a narrow point.

Leaf sheath—The tube-like portion of a grass leaf which is wrapped around the stem. An individual leaf sheath arises at a stem node and ends where the leaf blade begins.

Nodes—The "joints" along a stem from which leaves arise; nodes on rhizomes give rise to small leaf scales, roots, and new plants.

Rhizome—An underground stem with a rootlike appearance and which produces rootlets at the joints or nodes. Capable of growing upward at the apex and giving rise to a new plant.

Rosette—A cluster of spreading or radiating leaves at the base of a plant.

Tap root—The primary, central, descending root of a plant from which most other roots arise.

CALCULATING RATES

Only by reading the label on the herbicide containers, and understanding the terms used, can one be certain of how to prepare a spray solution of the desired strength. Confusion arises because herbicides are prepared in many different concentrations. Recommendations in this bulletin for the amount of an herbicide to be used are stated in terms of **active ingredient** when the uncapitalized **common name** of the herbicide is used because materials with the same common name can exist in various concentrations. (Examples: 2,4-D; dalapon; silvex; DNBP) Recommendations are for **actual measure** of the herbicidal concentrate when capitalized **trade names** of herbicides are specified because these names imply a formulation of specific, known concentration. (Examples: Butyrac 118; Kuron; Banvel D) See table 1 for **common names** and selected examples of **trade names** of herbicides.

The label on every herbicidal product includes the **name** of the herbicidal active ingredient, the **amount** of active ingredient in the pro-

duct, and directions for mixing and use. Carefully follow directions of the manufacturer and those supplied in this bulletin when using herbicides on lawns. If you are in doubt concerning some aspect of applying herbicides, contact your local Cooperative Extension Agent.

Directions on many herbicidal preparations are more appropriate for farmers and others treating large areas who apply herbicides in "pounds of active ingredient per acre". Because lawnkeepers are concerned with applications to much smaller areas, the following table will be helpful for converting label information to values useful for weed control in lawns.

In addition to the highly concentrated herbicides which require considerable dilution with water (referred to in the tables of this bulletin), some manufacturers supply weed killers especially formulated for lawn use. Many of these require little or no dilution. Manufacturers' directions for rates of application should be followed carefully for these products.

Table 2. Guide for mixing herbicides for use as an overall spray on home lawns. The concentration of the herbicide as shown on the label of the container of a liquid herbicidal concentrate will usually fall within the range of concentrations shown in the first two columns of the table. The amount of herbicide required to prepare a spray solution to treat an area of 1,000 square feet at the rate of **one pound per acre** is indicated in the last column of the table.

Concentration shown on label of herbicidal concentrate container		Amount of herbicide to add to water ¹ to spray 1,000 square feet of lawn if desired rate of application of active ingredient is one pound per acre . ²
Percent acid equivalent	or Pounds acid equivalent per gallon	Tablespoons of herbicidal concentrate
Phenoxy herbicides³		
5	0.5	12.5
10	1.0	6.2
20	2.0	3.1
30	3.0	2.1
40	4.0	1.5
50	5.0	1.2
60	6.0	1.0
Dinitro herbicides⁴		
10-15	—	8.0
50-60	3.0	2.0

¹ Amount of water required to spray 1,000 square feet is determined by calibration of sprayer as described elsewhere in this bulletin.

² To apply herbicide at ½ pound per acre, use ½ the amount indicated; to apply 2 pounds per acre, use twice the amount shown, etc.

³ Phenoxy herbicides include 2,4-D; 2,4-DB; 2,4,5-T; silvex; MCPA; etc.

⁴ Dinitro herbicides include Simox PE, Premerge, and Dow Selective.

PRECAUTIONS WITH WEED KILLERS

Weed killer contact on ornamentals—Occasionally a phenoxy-type herbicide (2,4-D, silvex, 2,4,5-T, etc.) contacts foliage of desirable plants because of spray drift, spraying insecticides on ornamentals with a sprayer contaminated with phenoxy-herbicide residue, or other accidental means.

Twisting and contorting of leaves and stems is the first visible indication of the damaging effect of these herbicides. If this is noted, or if it is realized immediately after spraying that weed-killer has come in contact with ornamental foliage, cut the plant back to well beyond the contorted portion of the stems or remove the wetted leaves. This will remove the absorbed herbicide before it can move throughout the plant.

Cleaning sprayers — Always clean your sprayer immediately after using it. No cleaning other than rinsing with water is necessary if the sprayer is to be used only for pesticides applied to the lawn. However, if the sprayer has been used to apply 2,4-D, silvex or 2,4,5-T, do **not** use the sprayer for treating ornamental plants, fruits or vegetables unless proper steps are taken to remove this contamination. Sufficient residue from these herbicides remains in a sprayer even after several water rinsings to kill susceptible plants.

If it is necessary to remove contamination left by these herbicides, use either (a) a suspension of activated charcoal in water (10 tablespoons of activated charcoal and 5 to 10 tablespoons of laundry detergent in one gallon of water) or (b) a weak solution of household ammonia (2 table-

spoons of ammonia to one gallon of water). First rinse the sprayer thoroughly several times with vigorous agitation and flush the suspension or the solution through the hose and nozzle. Next, fill the sprayer with the cleaning agent and let it stand for 12 to 24 hours so that all parts that have been exposed to the herbicide (tank, pump, hose, valve, nozzle) are steeped in the solution. Spray the liquid down a drain and rinse the sprayer, hose and nozzle again with clear water before storing it. Rinse sprayer again just before using it for another purpose. Because it is very difficult to remove 2,4-D, silvex, and 2,4,5-T completely from equipment, and because some vegetables and ornamentals are extremely susceptible to these herbicides, the need for caution cannot be over-emphasized. An obvious alternative to this problem is to keep two sprayers, using one exclusively for applying 2,4-D and related chemicals.

USEFUL CONVERSION INFORMATION

One teaspoon=1/6 ounce of water=1/2 tablespoon
=1/48 cup=4.9 cubic centimeters (cc).

One tablespoon=1/2 ounce of water=3 teaspoons
=1/16 cup=14.7 cc.

One cup=1/2 pound (8 ounces) of water=1/2 pint
=16 tablespoons=237 cc.

One pint=1 pound (16 ounces) of water=2 cups
=32 tablespoons=96 teaspoons=473 cc.

One quart=2 pounds (32 ounces) of water=4 cups
=64 tablespoons=192 teaspoons=946 cc.

One ounce=28.3 grams=1/16 pounds

One acre=43,560 square feet=a square area measuring 209 feet on a side.

LAWN WEED IDENTIFICATION AND SPOT-TREATMENT CONTROL

On the following pages are illustrations and descriptions of twelve of the most troublesome and frequently encountered weeds in Alaskan lawns. If you desire identification of a weed that is not illustrated, bring or send a sample of this weed to the Cooperative Extension Service agent for identification and control recommendations. Send the sample fresh (wrapped in foil or waxed paper) or pressed and dried between sheets of paper. Send several plants including some with flowers or seed heads.

After a weed has been identified, procedures for its eradication can be selected. Accompanying the description of each weed are control recommendations to be used for "spot treatment" of the weed if it is present in low numbers or in small, isolated areas. If, however, the weed is generally present over a large area and an overall application of weed killer is to be applied, refer to the section of this bulletin describing calibration of the sprayer or spreader to be used and the preparation of weed-killer materials to be applied.

FIELD HORSETAIL is a perennial, rush-like plant that does not produce seeds. It reproduces by microscopic, dust-like spores in the same manner as ferns. Horsetail also spreads vegetatively by proliferating underground rootstocks as shown.

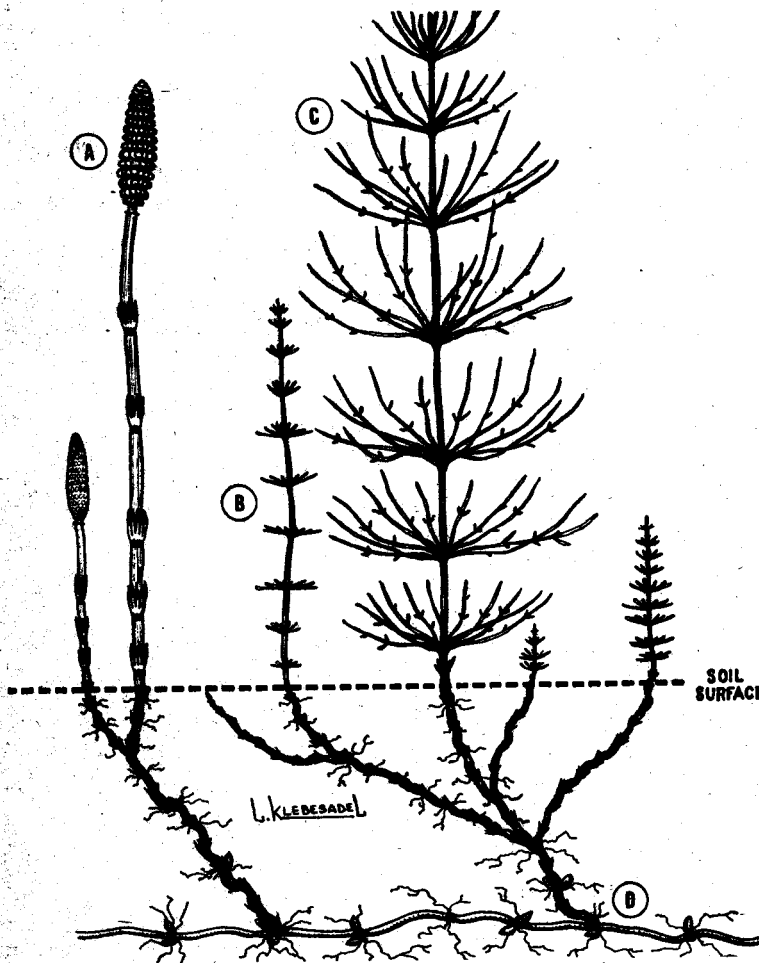
Horsetail is native to Alaska and occurs widespread throughout the state. It is tolerant of acid soil conditions and is often found on sandy, moist soils, along streams and roadsides, in marshes, swamplands, and sometimes in lawns.

The tan-colored, spore-producing stems first appear in very late April or early May. Each of these bears a small cone-like structure at its top within which the spores are produced. The bushy, vegetative stems appear soon afterwards and bear

whorls of numerous, slender, three-sided branches. Both types of stem are hollow. Each joint on the stems is surrounded by a ring of slender teeth that lie flat against the stem. This weed is known to be poisonous to horses when a sufficient quantity is consumed in hay.

SPOT-TREATMENT CONTROL—Horsetail can be controlled with MCPA or 2,4-D. Small infestations of horsetail can be eliminated with a spot-treatment spray prepared with one tablespoon of MCPA or two tablespoons of 2,4-D (formulations containing 4 pounds acid equivalent per gallon) in one gallon of water.

For **overall application** of weed killers to extensive infestations, see Tables 2 and 3.



FIELD HORSETAIL (*Equisetum arvense*) **A** Spore-producing head atop fertile stem. **B** Sterile, vegetative stem at immature stage. **C** Full-grown vegetative stem. **D** Underground creeping rootstock.

PROSTRATE KNOTWEED is an annual that reproduces only by seed. It is a tough, wiry weed that resists trampling and, like pineappleweed, is more tolerant than grass of hard-packed soils. For this reason, knotweed is especially prevalent with pineappleweed along the edges of paths and driveways where grass will not grow. It also occurs elsewhere in lawns.

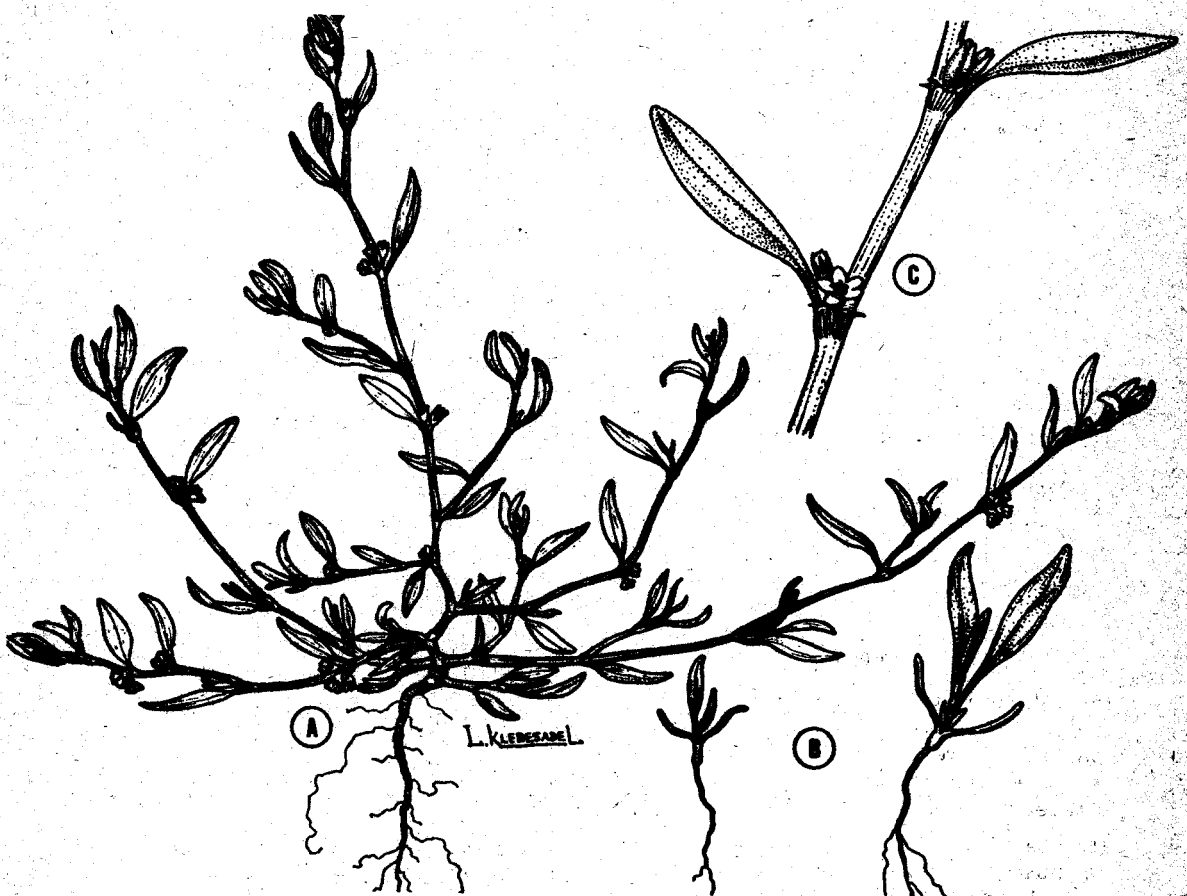
Leaves and stems are dark bluish-green. Several stems arise from the small taproot and grow prostrate if uncrowded. Leaves are alternate, small, narrow at the base and tapering toward the tip. Flowers are very small, white or pink and borne in inconspicuous clusters at the stem joints or nodes. Each node is covered with a thin, papery sheath. Seeds are small, slender, reddish-brown and triangular.

Areas of knotweed in the lawn may die and turn brown before the growing season ends, imparting an unattractive appearance to an otherwise green turf.

SPOT-TREATMENT CONTROL—Repeated sprayings with 2,4-D are effective at early stages of growth. This weed is very susceptible to the herbicide dicamba which at present is marketed only under the trade name Banvel D (see table 1). For spot treatment with sprayer, use 2 tablespoons Banvel D per gallon of water. Add a teaspoonful of household detergent to either spray mixture to cause better wetting of knotweed's somewhat waxy leaves. Spray knotweed patches **very lightly**. Repeat if necessary in 3 to 4 weeks. Knotweed stems turn red and become limp within two weeks after being sprayed with a lethal rate of dicamba.

For overall application of weed killers to extensive infestations, see Tables 2 and 3.

Extend sidewalks to areas of lawn that receive too much traffic and compaction for grass to thrive. Treat knotweed in gravel driveways with dicamba or a soil sterilant.



PROSTRATE KNOTWEED (*Polygonum aviculare*) **A** Whole plant. **B** Seedlings. **C** Segment of stem showing small flowers at nodes where leaves arise.

ANNUAL BLUEGRASS reproduces only by seed. It usually behaves as a summer annual but late summer seedlings may survive the winter in protected areas and function as winter annuals.

This weed grass resembles the desirable perennial Kentucky bluegrass except that annual bluegrass is more tufted in appearance because it does not spread by underground rhizomes like Kentucky bluegrass. Moreover, annual bluegrass grows less tall and is lighter green than Kentucky bluegrass. This color differential imparts an unattractive appearance to lawns.

Annual bluegrass seeds germinate late in spring, well after perennial turf species have become green. Therefore, lawn areas occupied by this weed are devoid of growth longer in spring.

The unique ability of annual bluegrass to produce many seed heads below cutting height in a mowed lawn, unlike perennial turf grasses, is another characteristic of this weed grass that imparts unattractiveness to a lawn. Many seed heads escape removal by the lawn mower and produce mature seed. This seed serves to perpetuate annual bluegrass in the lawn, once it has become established. Annual bluegrass readily invades weak or bare areas in a lawn, persists there and spreads by seeds dropped in place or scattered by action of the lawn mower.

SPOT-TREATMENT CONTROL—No selective foliar sprays are available that will kill annual bluegrass without damaging desirable grasses.

HOW TO USE THIS BULLETIN

The following hypothetical lawn weed problems, and the sequence of steps to their solutions, are presented to illustrate how the weed control information in this bulletin can be used most effectively.

Problem A: An unknown weed is generally distributed throughout an entire lawn.

Solution:

- (a) The weed is identified as knotweed from the illustrations and descriptions.
- (b) Table 3 reveals that knotweed is susceptible to dicamba at 1 to 2 pounds per acre.
- (c) Table 1 reveals that dicamba is available as the product Banvel D. A can of Banvel D is purchased and the label states that it contains 4 pounds of acid equivalent per gallon.
- (d) Table 2 discloses that an herbicidal concentrate that contains 4 pounds of acid equivalent per gallon should be used at 1.5 tablespoons of concentrate per 1,000 square feet of lawn to provide an application rate of one pound per acre. It is decided to apply Banvel D at 1½ pounds per acre, so 1½ times the one-pound rate is calculated ($1\frac{1}{2} \times 1\frac{1}{2}$ tablespoons = $2\frac{1}{4}$ tablespoons per 1,000 square feet).
- (e) Because of the extent and uniformity of the knotweed infestation, it is decided to apply a uniform, overall spray to the entire lawn. This method requires calibration of the application equipment. By following the directions for calibration it is found that the compressed air, tank sprayer to be used applied 1¾ gallons of water per 1,000 square feet.
- (f) The entire lawn is then sprayed uniformly (with same rate of travel as during calibration) with a solution consisting of 2¼ tablespoons of Banvel D to each 1¾ gallons of water required.

(Continued on page 18)

Individual plants can be eliminated with a dalapon solution applied with a sponge-on-stick or cane-type applicator. Prepare dalapon solution by dissolving 2 level tablespoons (one ounce) of dalapon in one quart of water.

Certain chemicals are reported to be effective as a spring application to the soil in preventing annual bluegrass seedlings from developing. No information is available on the effectiveness of these chemicals under Alaskan conditions.



ANNUAL BLUEGRASS (*Poa annua*) A Mature plant. B Seedling. C Young plant. D Boat-shaped leaf tip characteristic of bluegrasses. E Only one or two branches at bottom of short, pyramidal seed head. Kentucky bluegrass has three to five branches at this point and a more elongated seed head.

QUACKGRASS is undesirable in lawns because of the coarseness of its leaves and because it does not form a dense, uniform turf as compared to desirable lawn grasses.

Quackgrass is a very hardy, perennial grass that reproduces both by seed and by extremely vigorous, slender, underground rootstocks called rhizomes. The rhizomes possess a sharp growing point, produce roots at each node or joint and frequently send up shoots to form new plants as shown. When unclipped, quackgrass grows two to four feet tall and produces slender, unbranched seed heads as illustrated. A slight constriction can be noted in the leaves about $\frac{3}{4}$ of the blade length away from the stem. At the base of the leaf blade, a pair of small claw-like auricles clasp the stem as shown.

SPOT-TREATMENT CONTROL—No selective chemicals are available for overall spraying that will eradicate quackgrass from lawns without also

killing desirable grasses. An area heavily infested with quackgrass, whether an existing lawn or an area to be made into a lawn, may be treated with dalapon to kill all grasses after which desirable lawn grass may be seeded.

Quackgrass can be successfully removed from a small area by digging—making certain that all rhizome portions are removed—followed by refilling with soil uninfested with quackgrass and sodding the area or reseeding with desirable grass.

Another method for treatment of isolated plants of quackgrass may be used. Allow the quackgrass to grow 6 to 8 inches tall. Don a rubber glove on one hand and over that place a cotton glove. Dip the gloved hand into a dalapon solution (2 tablespoons dalapon per quart of water) and apply the solution to the quackgrass leaves by stroking the leaves between thumb and fingers of moistened glove. Use care to avoid contact with the finer-leaved desirable grasses.

(Continued from page 16)

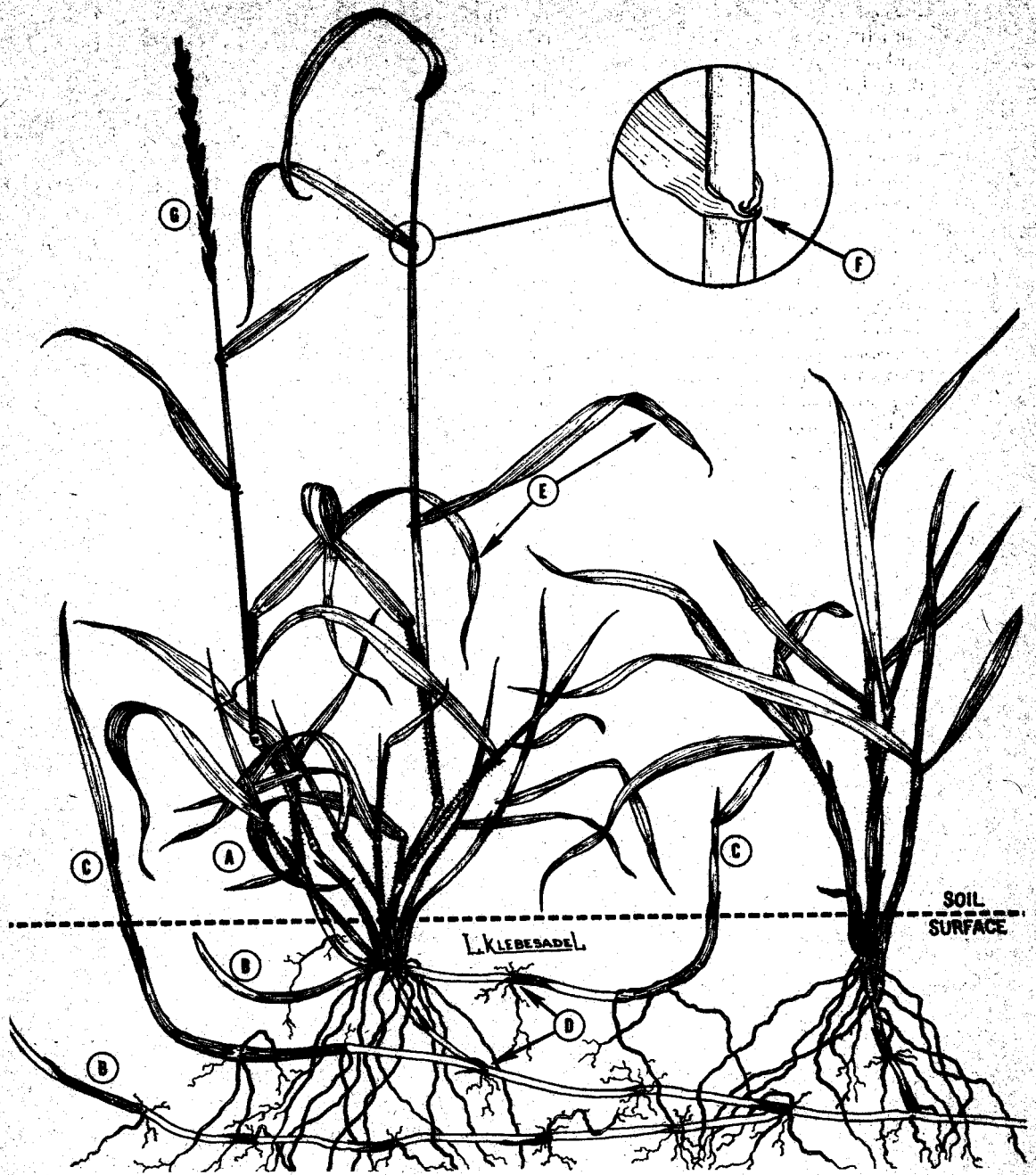
Problem B: One area of a bluegrass-white clover lawn is infested with several small patches of dandelion and plantain. Some of the plantain infestation extends into a small rock garden that contains some flowers and small, broad-leaved shrubs. The lawnkeeper desires to keep the clover in the lawn.

Solution:

(a) The herbicide 2,4-DB is selected for use because both dandelion and plantain are susceptible to it and white clover is tolerant of this form of 2,4-D.

(b) Because of the scattered presence of the weed patches, it is decided to treat the weeds with a spot-treatment application as suggested on the page of the white clover description.

(c) Owing to the nearness of sensitive ornamentals, a gravity-flow sprayer is used on the lawn itself because the coarse droplets and absence of air pressure minimize the possibility of spray drift. To treat the weeds in the rock garden, a somewhat stronger 2,4-DB solution is applied to individual weeds using a sponge-on-stick applicator because the density of sensitive plants in that area rules out spray application of any kind. Directions for preparation of this latter solution are also given in connection with the description and discussion of white clover.



QUACKGRASS (*Agropyron repens*) A Whole plant. B Creeping rootstocks or rhizomes. C New plants arising from rhizomes. D Nodes or joints on rhizomes—each capable of giving rise to a new plant. E Constriction in leaf blades near tip. F Minute stem-clasping claws called auricles at base of leaf blade. G Spikelike seed head.


BROADLEAF PLANTAIN is a low-growing perennial that occurs frequently in lawns and gardens. All leaves and seed stalks arise from the crown of the plant and no elongated stem exists. The leaves are oval, one to eight inches long, and possess prominent, parallel veins. The leaves form a rosette that grows upright in tall grass but becomes flattened against the soil surface in closely clipped lawns. Plantain's large, coarse leaves are unattractive in lawns and the weed tends to crowd out the grass.

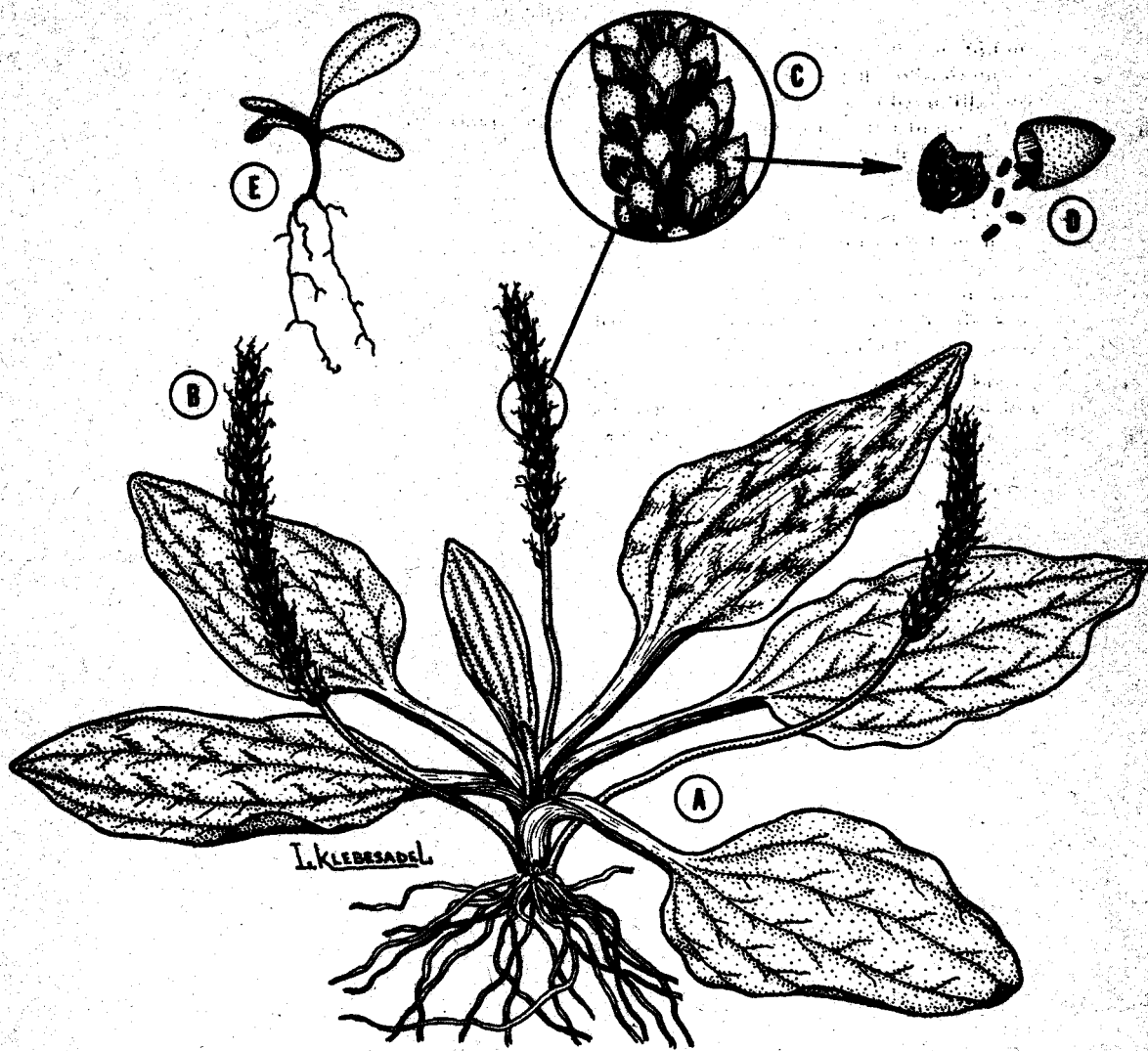
Plantain's root system is rather shallow. The roots are coarse and fibrous as shown. The flowers are small and inconspicuous. The flowers and the seeds are borne on long, unbranched spikes measuring two to ten inches in length. Plantain's seeds are very small and are borne in small capsules. Each plant is capable of producing a large

number of seeds because each of the many capsules usually contains well over two dozen seeds.

SPOT-TREATMENT CONTROL — Individual plants are easily removed by slicing well below the crown with a knife. Light infestations of plantain can be eliminated with a spot-treatment spray prepared with 2 tablespoons of 2,4-D (formulations containing 4 pounds acid equivalent per gallon) in one gallon of water. If infestation is light enough to permit treating individual plants, use a cane-type applicator or sponge-on-stick to apply a solution containing 10 tablespoons of 2,4-D (same formulation as above) in one gallon of water.

For overall application of weed killers to extensive infestations, see Tables 2 and 3.

 Names of products and manufacturers cited do not constitute endorsement. Names are used only where this information is necessary to provide knowledge of products likely to be unfamiliar to retailers or homeowners. Listings of products and manufacturers are neither assumed nor intended to be complete. Many other similar and satisfactory weed killers are available from a wide variety of sources.



BROADLEAF PLANTAIN (*Plantago major*) A Whole plant. B Seed stalk. C Section of seed stalk enlarged to show capsules. D Individual capsule as it opens at maturity to release seeds. E Seedling.

COMMON CHICKWEED is one of Alaska's most abundant weeds in both lawns and agricultural croplands. It is a succulent-tissued, annual weed that thrives best during the cool, moist weather characteristic of the latter half of the growing season.

The foliage of chickweed is yellow-green in contrast to the darker green of perennial lawn grasses. The lighter color of chickweed plants imparts a patchy, unattractive appearance to lawns. Its vigorous growth allows it to smother out desirable lawn grasses.

Chickweed is shallow-rooted. It starts from seed each year and spreads rapidly to form mats of much-branched, creeping, trailing stems that develop roots at the lower nodes or joints. The prostrate growth of chickweed allows most of the plant to escape cutting by lawn mowers.

The round or egg-shaped, pointed leaves are arranged in pairs on the stems. The flowers are small, white and somewhat starlike in appearance. They continue to bloom in the fall until frost kills the foliage.

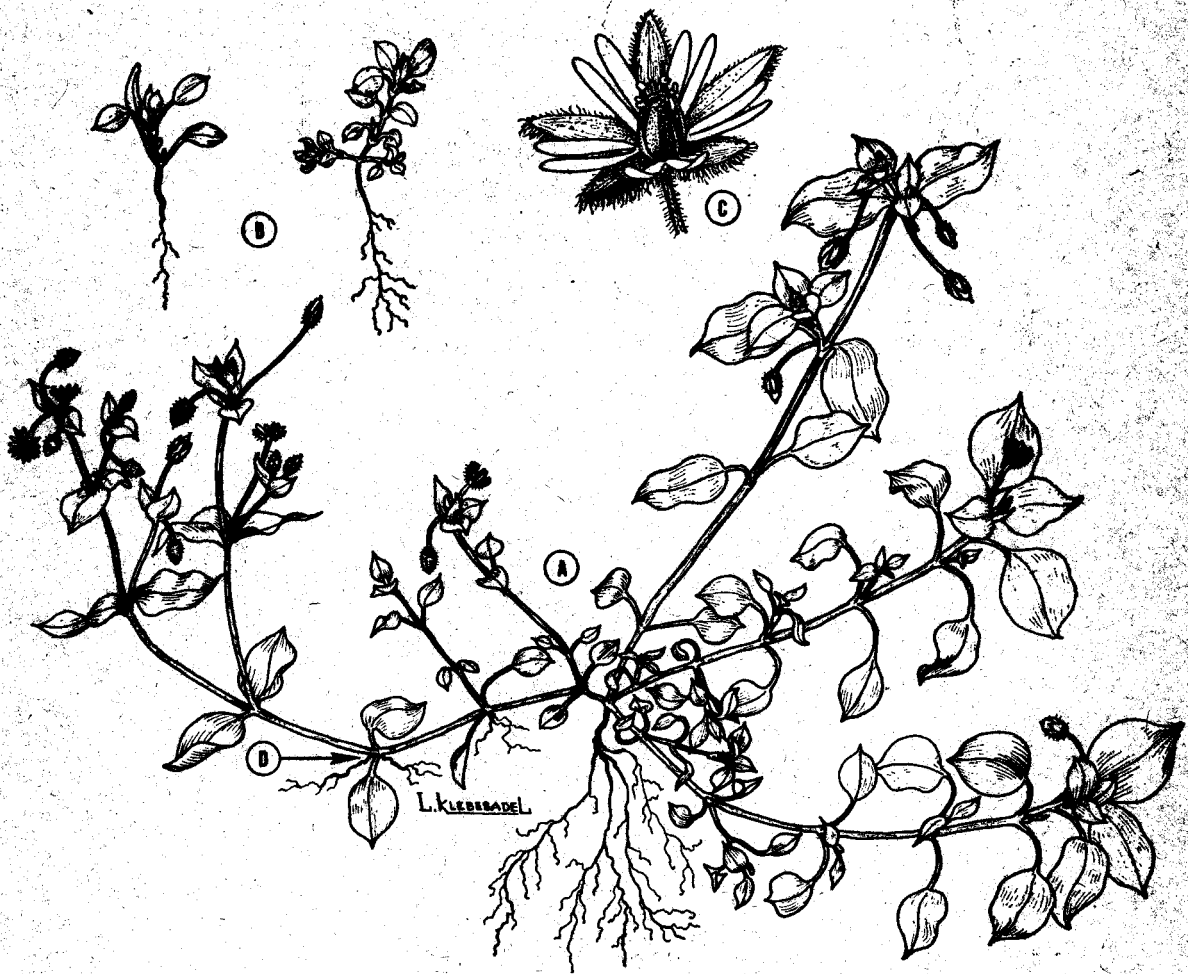
SPOT-TREATMENT CONTROL — Hand-pulling is usually unsatisfactory because chickweed stems are weak and break apart easily. Moreover, because the stems take root, it is extremely difficult to hand-pull every stem portion that can regenerate to form another plant.

Chickweed is very sensitive to certain chemicals, especially DNBP. For spot treatment with DNBP, use 4 tablespoons of Premerge or Sinox RE per gallon of water. Spray chickweed foliage **lightly**. Chickweed leaves and stems will whiten in 3 to 5 days and shrivel. Heavy mats of chickweed may require retreatment because DNBP is not translocated in the plant but kills only the foliage it contacts. Underlying leaves shielded from spray in the first application can be killed by a subsequent application.

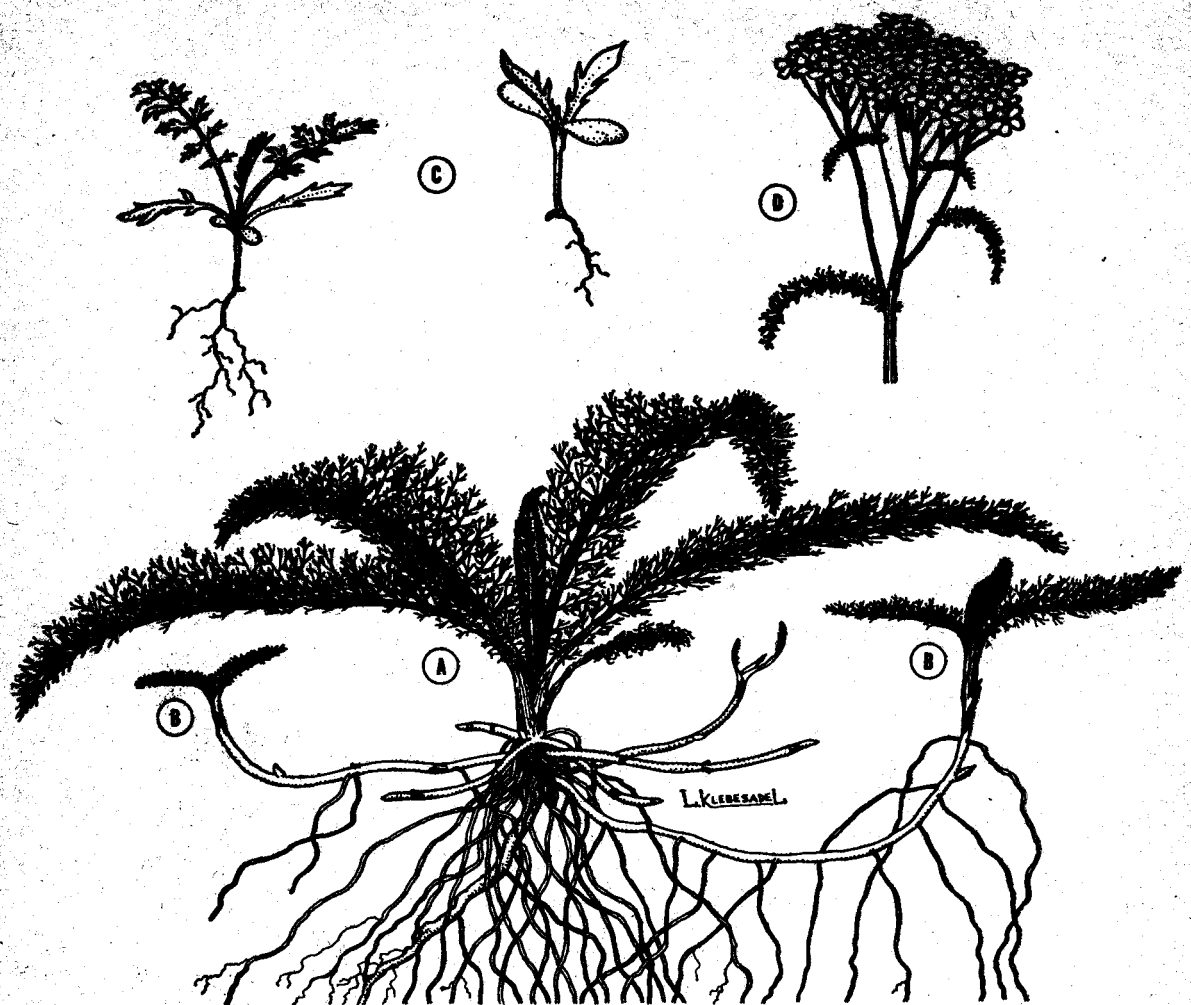
Other effective spot-treatment mixtures are Banvel-D (dicamba), at two tablespoons per gallon of water and Kuron (silvex) at 2 tablespoons per gallon.

For **overall application** of weed killers to extensive infestations, see Tables 2 and 3.

The author, the University of Alaska Agricultural Experiment Station and Crops Research Division, U. S. Department of Agriculture assume no responsibility for any harm resulting from the use of lawn weed killers. Recommendations contained herein are supplied as the best information available from trials in Alaska and elsewhere.



COMMON CHICKWEED (*Stellaria media*) A Whole plant. B Seedlings.
C Flower. D Roots at node on stem.

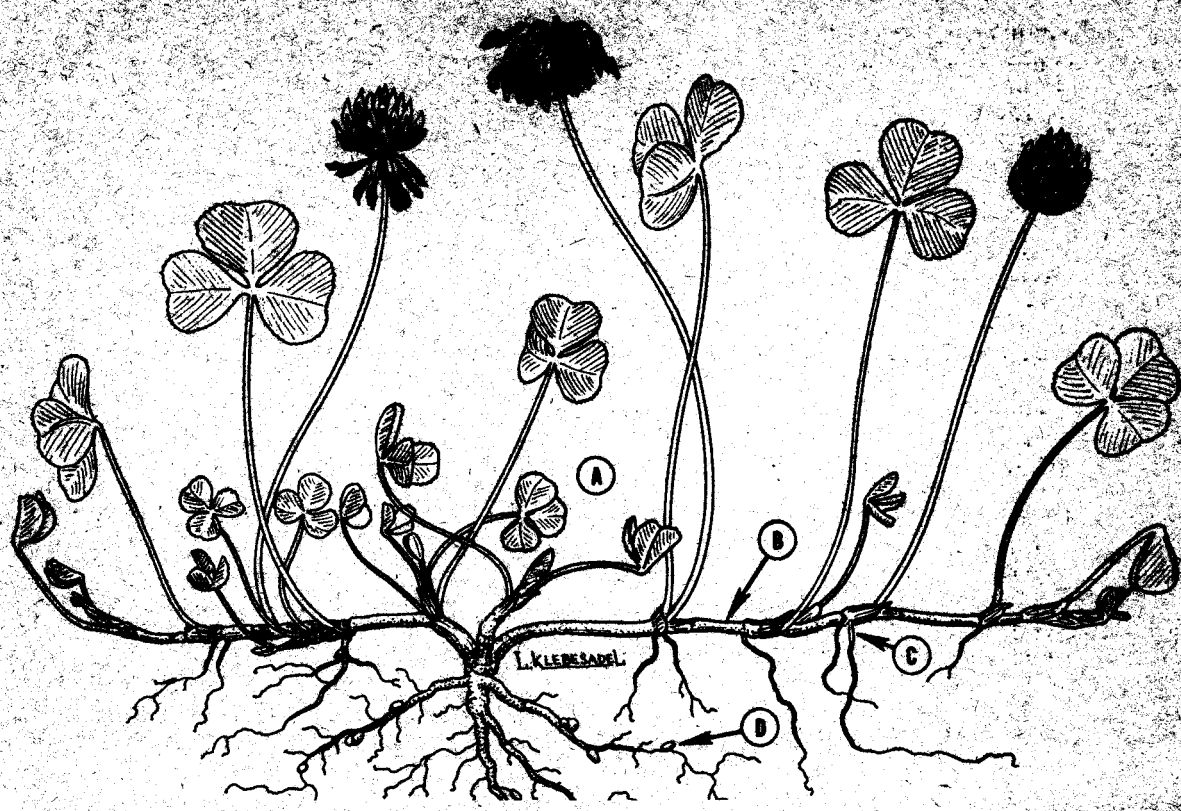


YARROW (*Achillea millefolium*) **A** Rosette-type plant. **B** New plants arising from underground rootstocks. **C** Seedlings. **D** Flower cluster.

YARROW is a perennial weed that is common in pastures, along roadsides, and in untended areas. In such areas it is allowed to develop aerial stems that attain a height of one to 2½ feet. These unbranched, hairy stems give rise to finely divided leaves along their entire length and are topped with tiny white or pink flowers. When yarrow occurs in lawns, mowing prevents the development of stems and the weed is present only as unbranched, delicate, fernlike leaves as shown above. Yarrow reproduces by seed but also spreads in lawns by underground rootstocks as shown.

SPOT-TREATMENT CONTROL — Yarrow is little affected by 2,4-D and related phenoxy herbicides. Results to date indicate that the herbicides dicamba or DNBP are the best choices available for killing yarrow. Spot-treatment spray solutions can be prepared consisting of 3 tablespoons of Banvel D (dicamba) per gallon of water of 4 tablespoons of Premerge or Sinox PE (DNBP) per gallon of water.

For overall application of weed killers to extensive infestations, see Tables 2 and 3.



WHITE CLOVER (*Trifolium repens*) A Whole plant. B Prostrate stem or stolon. C Root from stolon. D Root nodule containing bacteria able to capture atmospheric nitrogen for plant.

WHITE CLOVER in lawns is liked by many people. It is sometimes seeded with grass. A uniform stand of clover detracts little from a lawn's appearance. Clovers ability to capture atmospheric nitrogen and contribute this fertility to the lawn deserves consideration. However, many consider white clover to be a weed in lawns and it is included here for that reason.

White clover enjoys a considerable competitive advantage over grasses in lawns that receive too little nitrogenous fertilizer. Fertilizer nitrogen eliminates clover's advantage and creates vigorous, more competitive grass.

White clover starts from seed and spreads in lawns by prostrate creeping stems called stolons that develop roots at each node. It spreads rapidly and is little damaged by mowing.

SPOT-TREATMENT CONTROL— White clover is susceptible to several herbicides including silvex; dicamba; 2,4,5-T; and 2,4-D. Prepare a spray solution for spot treatment application consisting of 2

tablespoons of one of the above formulations (that contains 4 pounds acid equivalent per gallon) in one gallon of water. Wet all leaves completely but do not spray so heavily that solution runs off.

White clover is quite resistant to 2,4-DB (the butyric formulation of 2,4-D). Those who consider white clover to be desirable in a lawn can use 2,4-DB to remove 2,4-D-susceptible weeds from a lawn containing clover. An overall spray with 2,4-DB can be prepared with the aid of the tables in this bulletin. A 2,4-DB solution for spot-treatment spraying can be formulated by adding 6 tablespoons of Butyrac 113 (a 2,4-DB product containing 2 pounds of acid equivalent per gallon) to one gallon of water. A spot-treatment solution to be applied to individual plants with a cane-type applicator or sponge-on-stick can be prepared by mixing approximately 20 tablespoons Butyrac 118 in one gallon of water.

For overall application of weed killers to extensive infestations, see Tables 2 and 3.

SHEPHERDSPURSE is very common in Alaska. It occurs along roadsides and in croplands, gardens, lawns and untended areas. Shepherdspurse is usually not as serious in lawns as many of the other weeds described on these pages.

Shepherdspurse reproduces only from seed and behaves either as a summer annual or winter annual. As a summer annual, seeds germinate early in the season and result in plants that develop few basal leaves. However, flowering stalks are produced that go to seed as shown. Plants from seeds that germinate later in the season produce a dominant basal rosette of leaves and either no flower stem or a short stem that begins to flower but does not reach maturity. These plants, if they survive the winter, behave as winter annuals by completing their reproductive phase early during the following season.

Basal leaves are two to six inches long with irregular margins. Leaves borne on the flower stems are smaller, stalkless, and alternate. They clasp the stem with earlike projections.

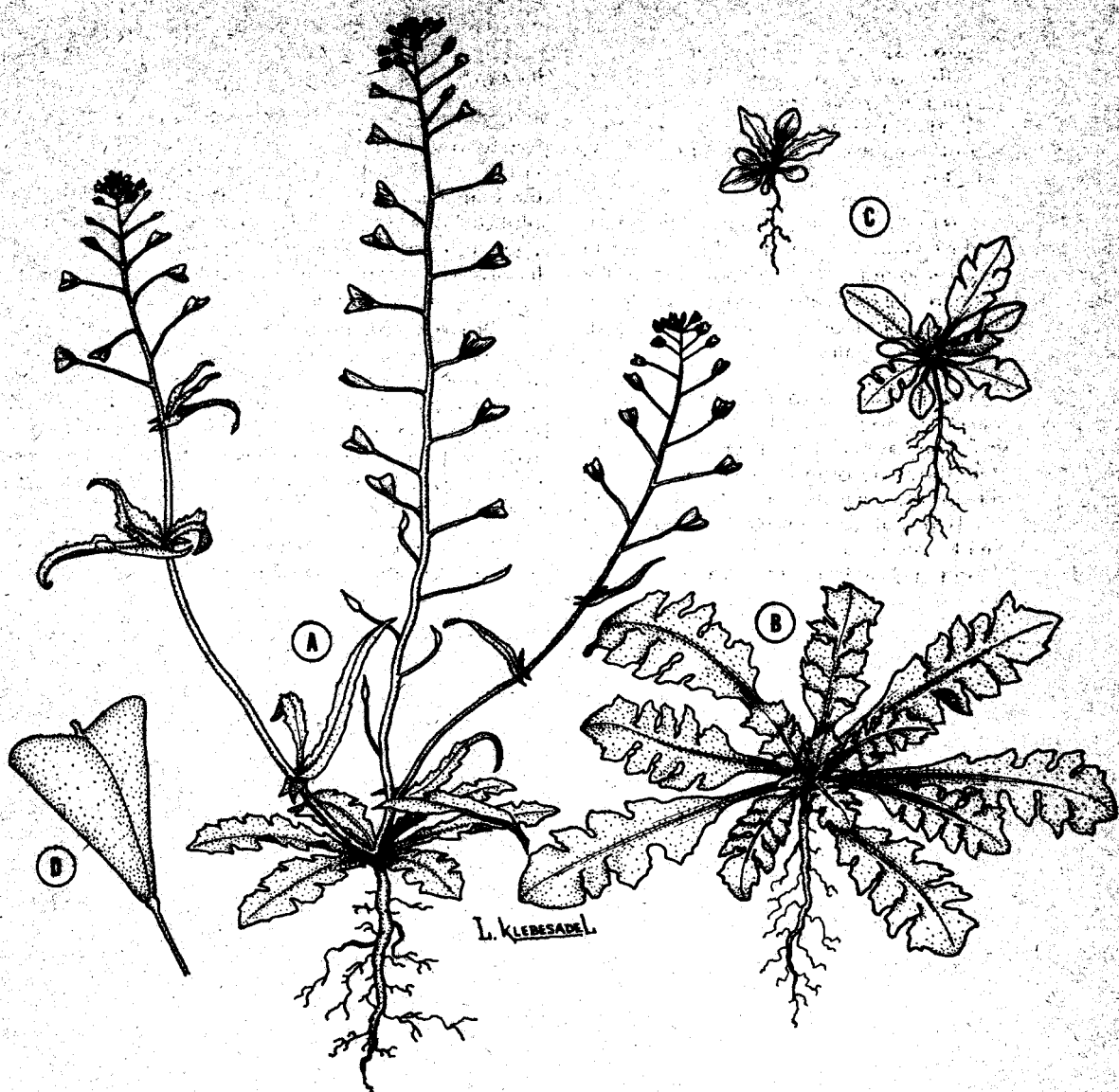
Flowers are small and white. The most distinctive feature of this weed is the triangular

shape of the small, flat seed pods. These pods are about $\frac{1}{4}$ inch long and borne on small stalks that project outward from the main stem. The very small, orange-brown seeds are produced in abundance. When the seed pods become mature, the pod falls away in two halves releasing the seeds. A thin membrane that divided the pod into two compartments remains attached to the seed stalk as shown at the bottom of the middle flowering stem illustrated above.

SPOT-TREATMENT CONTROL — Shepherdspurse can be controlled with several herbicides. Satisfactory solutions for spot treatment are 4 tablespoons of Premerge or Sinox PE per gallon of water applied as a light spray; or one of the following—2,4-5T; silvex; 2,4-D; or MCPA (formulations containing 4 pounds acid equivalent per gallon) at 3 tablespoons per gallon of water applied as a spray.

For overall application of week killers to extensive infestations, see Tables 2 and 3.

Successful lawn weed control depends primarily on good cultural practices and, where this is inadequate, on more direct control measures including use of chemical weed killers. Satisfactory chemical weed control requires correct identification of weeds, selection of appropriate weed killers, and effective application at the proper rate.



SHEPHERDSPURSE (*Capsella bursa-pastoris*) **A** Whole plant with floral stems and seed pods. **B** Whole plant consisting of leafy rosette with no floral stem (or very short, immature one) typical of late summer plants from seed that germinates during mid-season. **C** Seedlings. **D** Enlarged seed pod.

FOXTAIL BARLEY is a perennial grass that spreads by seed. It forms dense, tufted clumps and in mowed lawns the outermost stems usually become very prostrate. Foxtail barley is a very common weed in Alaska especially in overgrazed, poorly fertilized pastures and untended places such as roadsides.

It has an extensive, fibrous root system and, when the entire plant is hand-pulled, a large mass of soil is removed with the roots leaving a hole in the lawn. Leaves are rough, somewhat gray-green in color and one to six inches long. Leaf sheaths are very hairy.

Seed heads are two to four inches long and possess a large number of stiff, brittle, rough, hairlike awns. The awns are green when immature. Later they become shiny and bronze colored, and finally turn dull and straw colored at maturity. When mature, the awns diverge and the seed head comes apart freeing individual seeds with long awns attached. The awns pro-

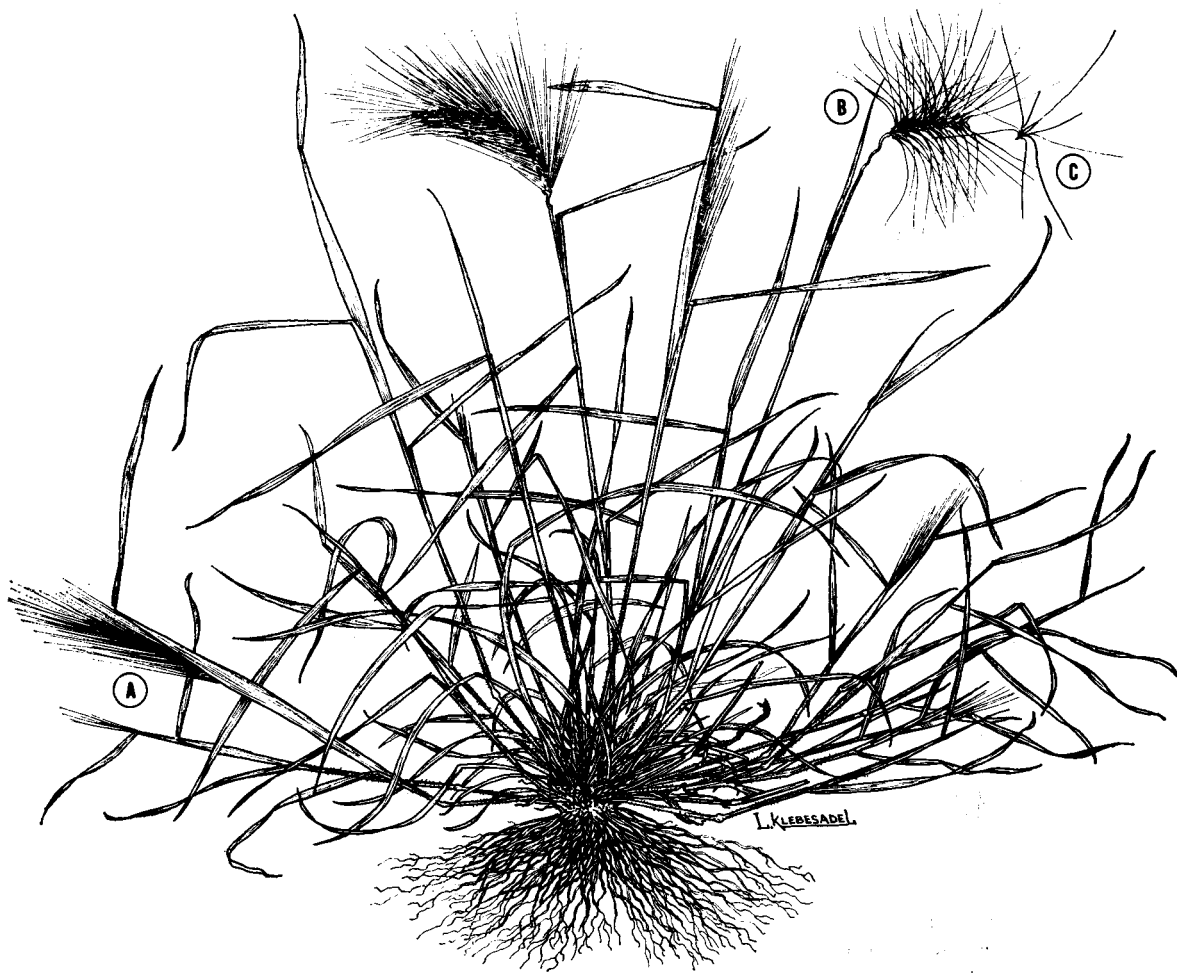
ject from structures that enclose the seed. The awns enable foxtail barley seeds to travel great distances in strong winds.

SPOT-TREATMENT CONTROL—There are no selective foliar sprays for lawns that will kill foxtail barley without damaging desirable grasses. Individual plants can be eliminated with a dalapon solution applied with a sponge-on-stick or cane-type applicator. Prepare dalapon solution by dissolving 2 level tablespoons of dalapon powder in one quart of water.

Prevent foxtail barley from going to seed in areas near your lawn. A dense, healthy turf is very effective in preventing this weed from invading your lawn. Individual plants of foxtail barley can be eradicated by severing below the crown with a knife. If a heavy infestation is present, it may be best to work up the area and re-establish the lawn.

For overall application of weed killers to extensive infestations, see Tables 2 and 3.

READ ALL LABELS CAREFULLY AND COMPLETELY! Precautions and instructions supplied with weed-killer products have been carefully devised for your protection.



FOXTAIL BARLEY (*Hordeum jubatum*) **A** Seed head emerging from boot. **B** Mature seed head breaking apart to release seeds. **C** Individual seed showing attached awns.



DANDELION (*Taraxacum officinale*) A Whole plant. B Unopened flower bud. C Flower. D Closed flower after blooming. E Seed ball. F Seedlings.

DANDELION is a perennial that spreads by seeds. It occurs very commonly along roadsides and in lawns, pastures, and untended areas. Dandelion possesses a thick, fleshy tap root that gives rise to a rosette of long, deeply cleft, pointed leaves. The leaves tend to be prostrate and spreading in a lawn and can compete for space against the best grass sod. The flower stalks, like the leaves, arise directly from the crown of the plant. Leaves and flower stalks both contain a milky juice.

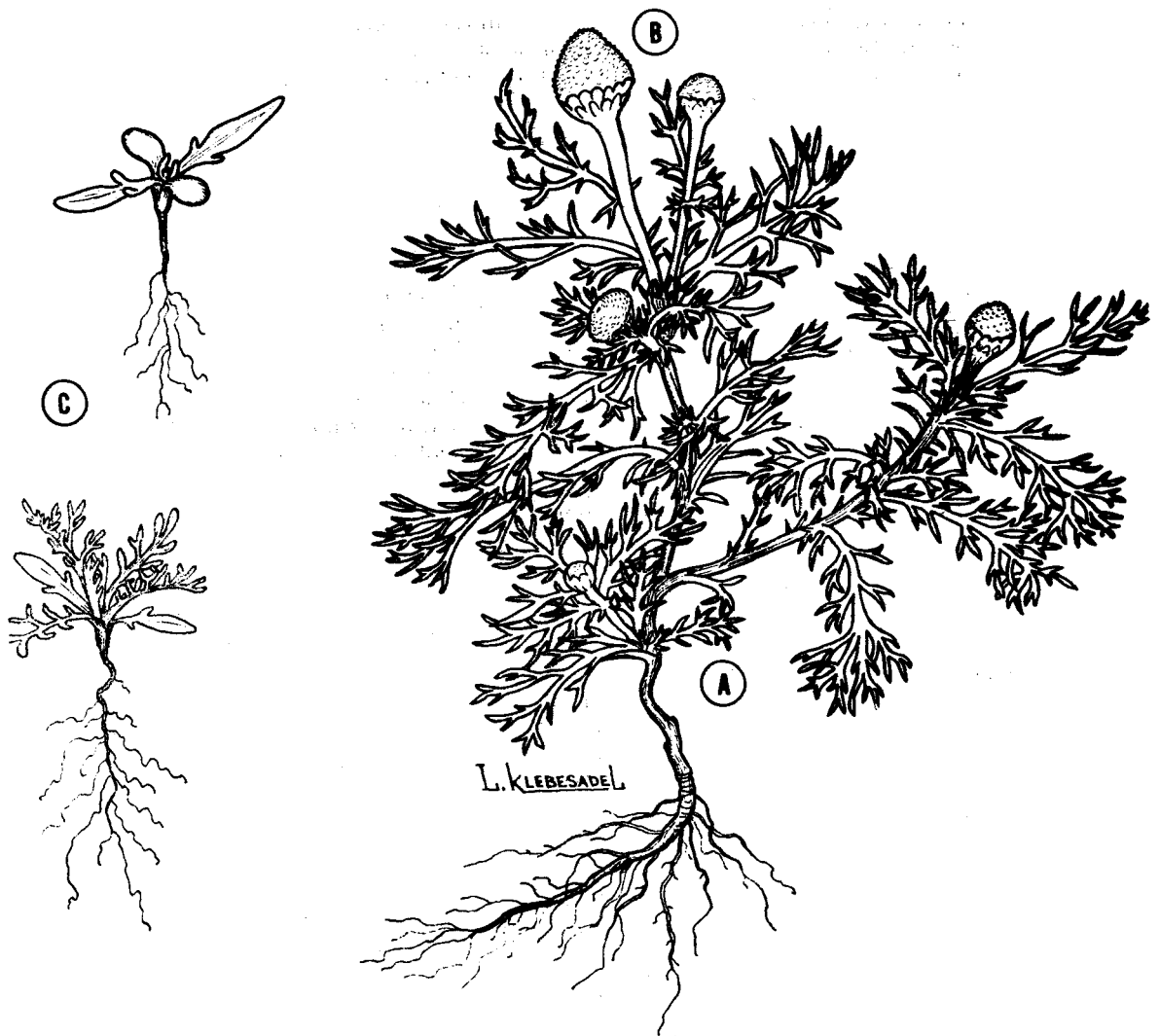
Each flower stalk produces a single flower. Flowers are from one to two inches in diameter and bright yellow in color. After blooming the flower closes, then reopens as a delicate, white ball composed of a great many seeds each with

white, hairlike tufts borne on a minute stalk as shown. Dandelion produces a number of seeds, easily windborne and widely disseminated.

SPOT-TREATMENT CONTROL—A well fertilized vigorous lawn will do much to resist invasion by dandelion. This weed is susceptible to 2,4-D and several other herbicides (see table 3).

A heavy infestation throughout a lawn should be treated with a uniform overall spray of 2,4-D or other effective weed killer. Spot treatments for dandelion are identical to those described for broadleaf plantain.

For **overall application** of weed killers to extensive infestations, see Tables 2 and 3.



PINEAPPLEWEED (*Matricaria matricarioides*) A Whole plant. B Flower C Seedlings.

PINEAPPLEWEED occurs frequently in lawns, especially those that are low in fertility with sparse and weak grass growth. Pineappleweed, like knotweed, can persist along paths and driveways where soil becomes hard-packed and where grass will not grow.

Leaves of pineappleweed are finely divided and arise from a branched stem. When leaves are crushed by rubbing between fingers, an odor resembling that of pineapple can be detected. Flowers of pineappleweed are small and yellow-green. They resemble a daisy flower except they are without the outer ring of ray petals that cause daisies to be showy. Each flower produces a large number of small seeds.

SPOT-TREATMENT CONTROL—Pineappleweed is quite resistant to most of the commonly used herbicides. Both dicamba and 2-(MCP), however, offer promise of controlling this weed. Prepare spot-treatment spray solutions with 3 tablespoons of Banvel D (4 pounds dicamba acid equivalent per gallon) per gallon of water or 10 tablespoons of Compitox (1.25 pounds 2-MCP acid equivalent per U. S. gallon) per gallon of water. Spray lightly as the tolerance of lawn grasses to these relatively new herbicides is not well known.

For overall application of weed killers to extensive infestations, see Tables 2 and 3.

Table 3. Common lawn weeds, herbicides effective on those weeds, and recommended rates of application. Several herbicides are listed for the control of each weed to assist in choosing weed killers that will be effective when more than one kind of weed is to be sprayed.

Weeds	Effective herbicides ¹	Recommended application rate (pounds per acre) ²
Horsetail	MCPA 2,4-D	½ to 1 1 to 1½
Annual bluegrass	dalapon	These grassy weeds cannot be eliminated by spraying the lawn without also killing desirable grasses. To kill all grass before reseeding, apply dalapon at 10 to 15 lbs. per acre (¼ lb. per 1,000 sq. ft.) in water. Allow 4 weeks between treatment and reseeding.
Foxtail barley	dalapon	
Quackgrass	dalapon	
Knotweed	dicamba 2-(MCP)	1 to 2 1 to 2
Chickweed	DNBP silvex 2,4,5-T dicamba	1½ to 2 1 to 1½ 1 to 1½ 1 to 2
Shepherdspurse	DNBP 2,4,5-T silvex 2,4-D dicamba MCPA	1½ to 2 1 to 1½ 1 to 1½ 1 to 1½ 2 to 2½ 1 to 1½
White clover	silvex 2,4,5-T dicamba 2-(MCP) 2,4-D	1 to 1½ 1 to 1½ 2 to 2½ 1 to 2 1 to 1½
Plantain	2,4-D silvex 2,4,5-T 2,4-DB MCPA	1 to 1½ 1 to 1½ 1 to 1½ 2 to 2½ 1 to 1½
Yarrow	dicamba DNBP	2 to 2½ 1½ to 2
Pineappleweed	dicamba 2-(MCP)	2 to 2½ 1 to 2
Dandelion	2,4-D 2,4,5-T silvex dicamba MCPA	1 to 1½ 1 to 1½ 1 to 1½ 1 to 2 1 to 1½

¹ See Table 1 for examples of trade names of these herbicides.

² Rates are given in weight of active ingredient. Therefore, these values are applicable regardless of the concentration of the herbicidal formulation to be used.

See Table 2 to convert "pounds of active ingredient per acre" shown in this table to "tablespoons of concentrate" to add to water for treating each 1,000 square feet of lawn surface.