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EC68-178 Lawn Weeds and their Control

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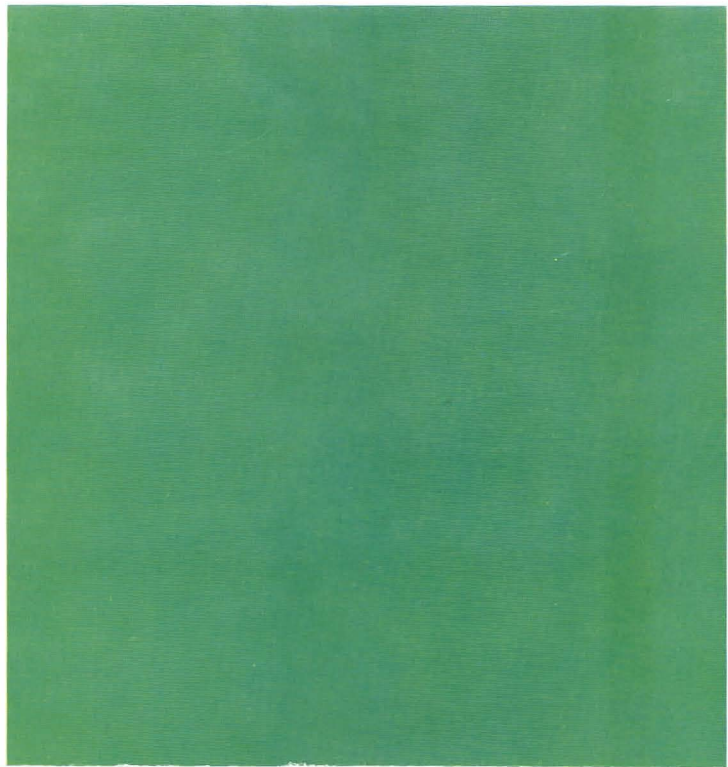


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Lawn Weeds and their Control



EXTENSION SERVICE UNIVERSITY OF NEBRASKA
COLLEGE OF AGRICULTURE AND HOME ECONOMICS
AND U. S. DEPARTMENT OF AGRICULTURE COOPERATING
E. F. FROLIK, DEAN J. L. ADAMS, DIRECTOR

Contents

Illustrations and Descriptions

Weed	Page	Weed	Page
Barnyard grass	4-5	Plantain	10-11
Bedstraw	4-5	Prostrate knotweed	10-11
Black medic	4-5	Prostrate pigweed	10-11
Bromegrass, smooth	4-5	Prostrate vervain	10-11
Chickweed, common	4-5	Puncturevine	10-11
Crabgrass	4-5	Purslane	12-13
Creeping bellflower	6-7	Quackgrass	12-13
Dandelion	6-7	Red sorrel	12-13
Dock	6-7	Sandbur	12-13
Field bindweed	6-7	Shepherd's purse	12-13
Foxtail	6-7	Speedwell	12-13
Goosegrass	6-7	Spurge, prostrate	14-15
Ground ivy	8-9	Tall fescue	14-15
Henbit	8-9	Violets	14-15
Kochia	8-9	Waterleaf	14-15
Mallow	8-9	White clover	14-15
Moss	8-9	Yellow nutsedge	14-15
Musk thistle	8-9	Yellow woodsorrel	14-15
Nimblewill	10-11		

Discussion and Appendixes

Characteristics and Growth Habits	
Grasses and Broadleaves	3
Annuals, Biennials, Perennials	3
Cool Season-Warm Season	3
Management as a Weed Control Tool	16
Control Methods	
Mechanical	16
Preemergence	16
Postemergence	17
Herbicide Formulations	17
Liquid Application	18
Growth and Treatment Periods—Table I	19
Weed Response to Herbicides—Table II	20
Appendix I —Selective Postemergence Herbicides	21-22
Appendix II —Preemergence Herbicides	22-23
Appendix III—Combinations of Post and Preemergence Herbicides	23
Appendix IV—Products for Grass and Total Vegetation Control	23

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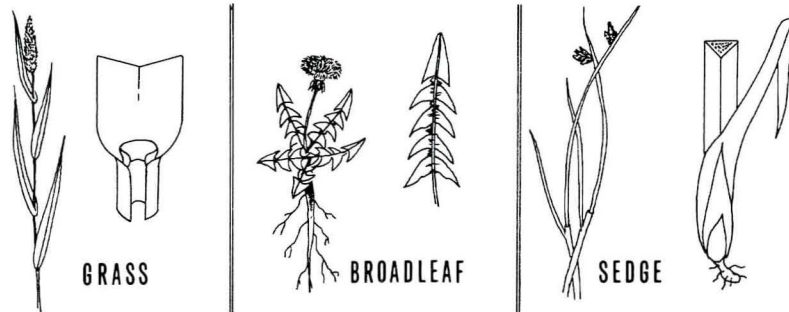
Control recommendations in this circular are based on research results of the University of Nebraska, U.S.D.A. recommendations, and label registrations. Suggestions are designed to benefit when control programs are needed. Recommendations are subject to withdrawal or change at any time.

In some instances trade names have been used to simplify recommendations. No endorsement is implied by the Nebraska Cooperative Agricultural Extension Service, and no discrimination is intended.

Lawn Weeds and Their Control

John D. Furrer¹

Homeowners with well-kept lawns often spend three to five dollars per 1,000 square feet for lawn weed control. Additional amounts are spent for seed, fertilizer, insecticides and fungicides. Correct identification, selection of the right pesticide, and proper application are helpful for the successful control of pests. Knowledge of plant characteristics and growth habits is helpful with both identification and control of weeds.



Grasses and Broadleaves

Most weeds belong to two principal families—grasses and broadleaves. Chemical controls for grasses and broadleaves usually differ.

True *grasses* have jointed hollow stems; the leaf blades have parallel veins and are several times longer than they are wide; the root systems are fibrous; and most seed heads are similar to small grain. Foxtail and quackgrass are typical grasses.

Broadleaf weeds often have showy flowers; the leaves have a network of small veins originating from a principal vein which divides the leaf in half; and a strong main root called a taproot is usually present. However, some broadleaf species do have fibrous root systems. Dandelion and knotweed are typical broadleaf species.

Sedges are grass-like plants with three-cornered stems which bear leaves extending in three directions. They are neither true grasses nor true broadleaves.

Annuals, Biennials, Perennials

Several additional groupings could be made but from a control standpoint, determination of life span—annual, biennial or perennial—is most important.

An *annual* germinates from seed, grows, matures, and dies in less than 12 months. Crabgrass, foxtail and prostrate spurge are examples

of annuals. Many annual weeds are effectively controlled with preemergence herbicides (chemicals applied to the soil to prevent germination and growth from seed). After annual weeds appear, postemergence herbicides (applied to the growing plant after emergence) work most effectively if used about 30 days after emergence.

A winter annual starts its life cycle in the fall and completes it the next spring. Henbit and shepherd's purse are winter annuals. Herbicides for their control are applied in the fall or early spring.

Biennials take two years to complete their life cycle. They form a rosette and store food in their fleshy root the first year and flower the second year. Many thistles are biennials. From a weed control standpoint, biennials can be considered as annuals or perennials. Control measures are most effective when applied during the first year's growth. If treatment is delayed until the second year, early season application of weed killers before bloom is important.

Perennials live more than two years. Field bindweed and white clover are typical perennials. Chemical control of perennials works best when applied to actively growing and well developed foliage about 30 to 40 days after spring growth begins. Late fall is a good time to treat perennials that re-

sume growth after summer dormancy.

Cool Season—Warm Season

Cool season plants grow best during cool periods and mature or go dormant during the hottest part of the summer. Bluegrass and dandelions are cool season perennials. Winter annuals are also cool season.

Timely chemical control for cool season species coincides with periods of active growth in late fall and early spring. Preemergence weed killers for the control of cool season annuals that germinate in the spring (knotweed for example) must be applied before April 1.

Plants that remain dormant vegetatively or as seed until temperatures warm up in May and June are known as *warm season* plants. Crabgrass, foxtail and prostrate spurge are typical warm season annuals. Germination of warm season annuals seldom occurs in Nebraska lawns before May 10. This gives additional time for application of preemergence chemicals.

Weedy warm season perennials such as nimblewill present objectionable appearances in cool season lawns. They remain dormant and brown in the spring 45 or more days longer than bluegrass. In the fall, warm season species turn brown after the first frost; cool season grasses usually remain green an extra 30 days or more.

Identification Aids

Comparison of a weed with pictures of the weed is the easiest way to identify an unknown. Note the distinctive characteristics listed for many of the species. Observe the growth habits. Does the plant grow upright or prostrate? Is the stem fleshy? Does it contain milky sap? Does it root at the joints? Does it have a square stem? Note whether a plant is annual, biennial, or perennial; cool season or warm season.

For example, a green weedy grass found in March is not crabgrass, foxtail, or nimblewill since they do not start growth that early.

¹ Agricultural Extension Specialist, Pesticide Chemicals.



Barnyardgrass



Brome grass, Smooth



Bedstraw



Chickweed, Common



Black Medic



Crabgrass

Barnyardgrass (*Echinochloa crusgalli* L.)

A coarse warm season annual grass with a flattened stem especially near the base. Lower portion of the plant tends to be reddish purple. The seed head branches into 6 or 8 short segments.

Bedstraw (*Galium* spp.)

Cool season annual most often found in the dense shade of trees and shrubs. The leaves and leaflike parts (stipules) form whorls at distinct intervals along the weak stems. The squarish stems have tiny saw-toothed appendages which cause plants to stick to clothing.

Other names: Cleavers.

Black medic (*Medicago lupulina* L.)

An annual legume with trailing stems that grow close to the ground. The taproot penetrates deeply into most soils. The three-leaflet leaves have prominent veins and are similar to most other clover leaves. The small clusters of flowers are bright yellow. Seed pods turn almost black at maturity. Black medic is most noticeable in lawns during June, July, and August.

Other common names: Yellow trefoil; Japanese clover.

Bromegrass, smooth (*Bromus inermis* Leyss.)

A cool season perennial highly prized for livestock forage. Most bluegrass lawns that contain smooth brome were started with pasture sod. The leaves are $\frac{3}{8}$ to $\frac{1}{2}$ inch wide and tend to be lax rather than upright. Close examination of an entire leaf will reveal an "M" or "W" across the leaf blade. The lower portion of the stem is almost white with prominent veins. Spread is primarily by underground root parts.

Chickweed, common (*Stellaria media* L.)

A hardy annual or winter annual with a delicate appearance found in green form most of the year. The small opposite leaves are oval-shaped and smooth. Stems are weak and tend to vine. The small star-like flowers are white. Common chickweed is most often found in the shade of trees and shrubs and especially on the north side of buildings. **Mouse-ear chickweed** (*Cerastium vulgatum* L.) is a perennial with creeping stems. The leaves, 2-3 times longer than wide, are clammy and fuzzy. Flowers are white; root system is shallow.

Crabgrass (*Digitaria* spp.)

Crabgrass is one of the most common warm season annual grassy weeds. The stems grow mostly prostrate, branch freely and send down roots where each joint comes into contact with the soil or moist grass. Seed head is divided into several fingerlike segments. Two principal species are (1) large crabgrass (*Digitaria sanguinalis* L.) sometimes known as hairy crabgrass and (2) smooth crabgrass (*Digitaria ischaemum* Schreb.) most common in the western part of the state. Smooth crabgrass tends to be smaller and oftentimes has reddish color on the stems.

Other common names: watergrass.



Creeping Bellflower



Field Bindweed



Dandelion



Foxtail



Dock



Goosegrass

Creeping bellflower (*Campanula rapunculoides* L.)

An escaped ornamental common in the western one-half of the state where it is a troublesome weed in many lawns. The flowers are showy, ranging from a deep blue to purple. Creeping bellflower is a cool-season perennial with a vigorous underground root system.

Other common names: European bellflower.

Dandelion (*Taraxacum* spp.)

Cool season perennial common throughout the midwest. Bloom from March to late November. At least two species are common to our lawns.

Dock (*Rumex* spp.)

Dock seldom reaches maturity when growing in lawns. The plant forms a large rosette. Curly dock (*Rumex crispus* L.) is most common. The leaves have crinkled edges. They are often tinted with red or purple color. Pale dock, also known as tall dock (*Rumex altissimus* Wood.), has leaves which tend to be more flat and broad. Both species have flowering stalks that may reach a height of two to three feet.

Field bindweed (*Convolvulus arvensis* L.)

A cool season perennial common throughout most of the United States. It is one of the more difficult weeds to eliminate. The leaf tips and basal lobes are rounded but vary considerably in shape and size. The flowers vary from white to light pink and are about the size of a nickel. The plant readily vines over shrubs and other ornamentals. It spreads by both seed and underground roots.

Other common names: Creeping Charlie; creeping Jenny; wild morning glory.

Foxtail (*Setaria* spp.)

Foxtails are warm season annuals that grow in association with crabgrass. Yellow foxtail (*Setaria glauca* L.) has flattened stems that are often reddish colored on the lower portion. The stems of green foxtail (*Setaria viridis* L.) are round. The seed of yellow foxtail is four times as large as green foxtail.

Goosegrass (*Eleusine indica* L.)

A warm season annual most often found growing where bluegrass stands are thin. The stems tend to be flattened and near the base are whitish in color. Flower heads are thicker and more robust than on common crabgrass. The extensive fibrous root system makes pulling difficult.

Other common names: Silver crabgrass and yardgrass.



Ground Ivy



Mallow



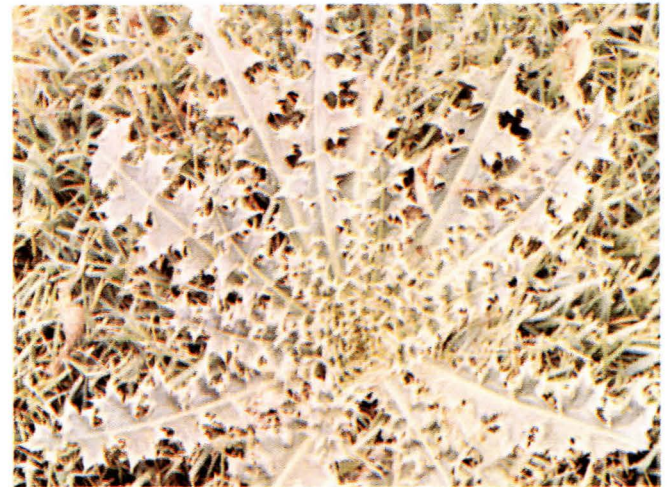
Henbit



Moss



Kochia



Musk Thistle

Ground ivy (*Glechoma hederacea* L.)

A cool season perennial originally introduced as a ground cover. Now a weed in many lawns. Thrives in shade, but will also grow in the sun. Ground ivy produces an abundance of lavender to blue funnel-form flowers in early spring. The square stems may root at each joint where they touch the ground.

Henbit (*Lamium amplexicaule* L.)

A winter annual that starts growth in September. Stems are squarish; plants usually upright. Flowers lavender to blue. Leaves opposite. A few plants may bloom in the fall but the majority blossom in late March and April.

Kochia (*Kochia scoparia* L.)

A versatile annual capable of adapting itself to a wide variety of environmental conditions. In lawns it assumes a prostrate habit of growth; in fence rows it may attain a height of 7 or 8 feet. The first leaves after germination are covered with a silvery pubescence. Germination starts in late March and continues throughout the summer. Leaves and stems vary in color from greenish yellow to greenish red.

Other common names: Burning bush, summer cypress, Mexican fireweed.

Mallow (*Malva* spp.)

Common mallow (*neglecta* Wallr.) is the most prevalent species; however, other species similar in appearance are present. The long fleshy taproot is almost white. Flowers are whitish blue. The seed portion is a flattened disc which breaks into 10 to 20 pie-shaped segments.

Other common names: Roundleaf mallow; cheeses.

Moss

A low form of plant life consisting of many genera and species. Moss prefers an environment that is cool and moist. It is most often found in shaded areas such as the north side of buildings.

Musk thistle (*Carduus nutans* L.)

A biennial found in lawns as a rosette. Leaves are free of hair and have a light colored midrib. Leaf lobes are usually edged in grey-green. Spiney. Flowers are large and ornate, usually orchid red.



Nimblewill



Prostrate Pigweed



Plantain



Prostrate Vervain



Prostrate Knotweed



Puncturevine

Nimblewill (*Muhlenbergia schreberi* J. F.)

A warm season perennial. The wiry fine stems root at the nodes; root system is shallow and fibrous; forms circular patches or may be distributed throughout the lawn. Objectionable in bluegrass lawns because of delayed spring growth and early dormancy in the fall.

Plantain (*Plantago* spp.)

Mostly cool season perennials that form rosettes with prominently veined leaves. The leaves and stems of blackseed (Rugel's) and broadleaf plantain resemble the miniature foliage and stalks of rhubarb. The leaves are oval shaped and 2 to 3 inches across. Stems are reddish or purple. The rat-tail like seed heads are several inches long.

Buckhorn plantain has leaves about 1" across. Prominent veins are present. The seed head is one to two inches long and about 1/3" across.

Prostrate knotweed (*Polygonum aviculare* L.)

An annual that thrives from early spring to late fall. Germination often takes place in late March and early April. Grows flat from a long white taproot. Individual plants may have a spread of 2 feet or more. Stems wiry, very leafy; at each joint there is a thin papery sheath. Leaves often have a bluish cast. Seeds are three-cornered, light-brown early and shiny black at maturity.

Prostrate pigweed (*Amaranthus blitoides* S.)

A warm season prostrate annual that grows from a pink taproot. The leaves are very shiny. Stems smooth, light-green to reddish green, may spread 1½ to 2 feet. Seeds are lens shaped, small, and shiny black.

Prostrate vervain (*Verbena bracteata* Lag.)

A warm season annual that may on occasion act as a perennial. Low growing, hairy throughout. Stems branch freely in all directions, forming circular patterns of growth. Leaves vary in size and form, often are wedge-shaped and toothed. Taproot. Small funnel-form flowers are blue to purple.

Puncturevine (*Tribulus terrestris* L.)

A prostrate, freely branching warm season annual. Plants slightly hairy. Some stems may be four or five feet long. Taproot. Leaflets bright green. Flowers yellow. Seeds angled, each with 2 stout spines that give a Texas longhorn appearance.



Purslane



Sandbur



Quackgrass



Shepherd's Purse



Red Sorrel



Speedwell

Purslane (*Portulaca oleracea* L.)

A warm season annual. Leaves and stems fleshy or succulent, reddish in color. Grows prostrate. Root system tends to be fibrous; stems root wherever they touch the ground, particularly if the main root has been destroyed. Flowers small, yellow. Seeds very small, black.

Other common names: Pursley.

Quackgrass (*Agropyron repens* L.)

A cool season perennial wheatgrass that spreads extensively by underground stems or roots. Leaf blades are twice the width of bluegrass and tend to be more harsh. One of the most distinguishing characteristics is a ring of root hairs every $\frac{3}{4}$ to 1 inch along the long white underground stems. The lower leaf sheath of the stem is hairy.

Other common names: Couchgrass.

Red sorrel (*Rumex acetosella* L.)

A low growing, cool season perennial that reproduces by creeping roots and seeds. Leaves are spear shaped and tend to resemble field bindweed. The lacy flowering stalks bloom in May and have a definite reddish color. The seed is small, three-sided and reddish brown. Remains green from very early March to early winter.

Other common names: Sheep sorrel.

Sandbur (*Cenchrus pauciflorus* Benth.)

A warm season annual grass most often found in turf areas that have been on low maintenance programs. Stems are flattened and branched; may be readily confused with yellow foxtail before formation of the spiny burrs.

Shepherd's purse (*Capsella bursa-pastoris* L.)

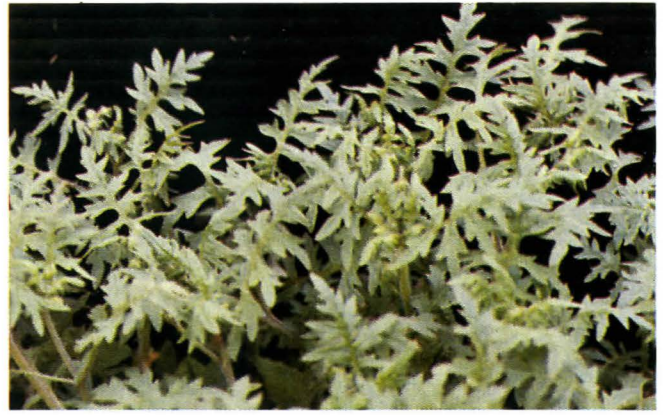
A winter annual. The deeply lobed leaves form rosettes in the fall that are easily confused with dandelion rosettes; however, the leaves lack the milky sap. Blooms in late March or early April. White flowers develop into triangular seed pods filled with numerous tiny brownish seeds. Individual seed pods held by their small stems resemble purses once carried by shepherds.

Speedwell (*Veronica* spp.)

Our most common species is a winter or early spring annual. The numerous leaves are small with scalloped edges. Plant very low growing; flowers light blue with white throat. Seed pods are divided and almost heart-shaped.



Prostrate Spurge



Waterleaf



Tall Fescue



White Clover



Violet



Yellow Nutsedge



Yellow Woodsorrel

Prostrate spurge (*Euphorbia maculata* L.)

A prostrate growing warm season annual. Most prominent in July, August, and September. Milky sap; leaves with or without reddish brown spots. Seeds are borne in three's in a capsule. Other common names: Milk spurge, spotted spurge.

Tall fescue (*Festuca arundinacea* Schreb.)

A very coarse cool season perennial bunch grass. Leaf veins are strongly fibrous; when mowed, fibers show on the cut edge especially if mowers are not well sharpened. Mature leaf blades may be one-half inch wide, ribbed above and shiny smooth below. The lower portions of the stems are reddish to purple, particularly in the spring and fall.

Violets (*Viola* spp.)

Cool season perennials that are among the first plants to bloom in the spring. Prefer at least partial shade. Flower color varies from very light blue to deep purple. Occasionally become troublesome in lawns. Numerous species common to our area.

Waterleaf (*Ellisia nyctelea* L.)

Cool season spring annual. Grows almost entirely in the shade of trees, shrubs and herbaceous perennials. Small white flowers; leaves grey-green. Other common names: *Ellisia*, *nyctelea*.

White clover (*Trifolium repens* L.)

A cool season perennial legume that spreads by underground and aboveground stems. May or may not be objectionable in lawns, depending on individual preference. Flowers white, sometimes with a tinge of pink. Seeds will live for 20 or more years in the soil. Other common names: White Dutch clover.

Yellow nutsedge (*Cyperus esculentus* L.)

Warm-season perennial. Triangular stems of sedges produce 3-ranked leaves from near the ground. Leaves light green and rather harsh. Lower portion of plant is fibrous and brown. Roots often terminate with small nutlets, about the size of a kernel of popcorn. Seed heads appear bur-like. Plants grow rapidly in July and August. Several species of sedge are common to our area, but this one is most prevalent in lawns.

Other common names: Nutgrass.

Yellow woodsorrel (*Oxalis stricta* L.)

Classified as a perennial but more often performs as a warm season annual. Stems branch from the base. The leaves are palmately divided into three leaflets giving a cloverlike appearance. Funnel-form flowers are yellow (in some species violet). The seed head develops into a long beak. The plant contains calcium oxalate which gives it a rather pleasing sour taste.

Management as a Weed Control Tool

Proper management can do much to encourage lawn grasses and discourage weeds.

Mowing at a height of 2½ to 3 inches shades the soil and protects bluegrass roots from damaging effects of summer heat. High mowing of common Kentucky bluegrass is an excellent deterrent to the germination and growth of many annual weed species. Some of the newer lawn grasses perform best when mowed two inches or less.

Feeding programs that furnish lawn grasses with necessary plant food elements throughout the growing season tend to discourage weeds through competition furnished by more vigorous bluegrass. Fertilize cool season grasses in the fall and spring and as needed during the summer months.

Withhold spring fertilization of warm season zoysia, buffalo, and Bermuda until May 1; stop fertilizing them about August 31.

Watering abundantly seldom if ever injures bluegrass. Water bluegrass as soon as it develops a blue-green cast. Applications of water before moisture shortage symptoms appear is even more desirable.

Seed and sod free of weed seed and off-type grasses is one of the first steps in weed control. Many lawns contain undesirable coarse grasses and weeds because they were present in the sod or seed. If you buy grass seed, study the label to make certain undesirable weeds and grasses are not present. Cultivated sod, inspected and treated to reduce weeds, is becoming more plentiful.

Control Methods

Mechanical Control

Digging and pulling are simple, effective ways of controlling a few scattered weeds. Dandelions should be cut 2" to 4" below the crown to reduce regrowth. Pulling of most species works best following a heavy rain or after deep watering.

Undercut and cut around small patches of undesirable grass with a sharp spade. Lift the undesirable patch and use it as a pattern to

cut a replacement piece the same thickness from an inconspicuous place elsewhere in the lawn. Make certain the replacement sod is firmed into place and well watered until it becomes established.

Preemergence Weed Control

Chemicals applied to the soil to prevent germination and growth of weed seed are preemergence herbicides. They work best on annuals. In some cases, preemergence herbicides will prevent the germination of biennial and perennial seed. Most preemergence products have little effect on emerged seedlings.

Proper lawn preparation is essential for optimum performance of preemergence products. Preparation for preemergence chemicals includes three simple steps:

1. Remove trash, leaves, and excess dead grass from the lawn. If power raking is planned, do it as part of the lawn preparation for preemergence chemicals.

2. Apply the preemergence product as directed on the bag or container. Distribute evenly. Double coverage at half rate in two directions assures more even distribution than a full rate applied in a single application.

3. After application, water the lawn. Watering moves the chemical into the soil where it can perform the intended job on germinating weed seeds.

Table 1 shows the most effective times of application. In general, preemergence applications are made in the very early spring for the control of cool season weeds and in April and early May for warm season annuals.

Products designed for preemergence weed control are labeled "Preemergence," "Preemergent" or "Preventer." Most preemergence herbicides sold for lawn use are bought as granules ready for application. The amount of active ingredient per 1,000 square feet or per acre is given as an aid for treating large areas with concentrated formulations.

Arsenicals, usually in the form of arsenic trioxide, lead arsenate and calcium arsenate, are used for long term control of crabgrass and other annuals in lawns. The compounds are highly toxic to warm-blooded animals. Toxicity to bluegrass also has been observed. Arsenicals act by replacing phosphorus, an essential plant food nutrient, in seedling grasses. Safer products are available.

Azak is a carbamate herbicide known by the common name terbutol. It can be used on all common lawn grasses; it does not control broadleaf species. After spring use, delay reseeding operations until fall. The suggested rate is 5 ounces of 80% wettable powder per 1,000 square feet or 10 lbs. of active ingredient per acre.

Balan, common name benefin, is similar to the soybean herbicide Treflan. It controls annual grasses in most perennial turf grasses but should not be used on bentgrass. Use only on well established turf. Do not seed until six to eight weeks after use. Suggested rate is 1½ lbs. of active ingredient per acre or ½ ounce per 1,000 sq. ft.

Bandane is closely related to the insecticide chlordane. It gives control of ants, grubs and certain other insects. It controls primarily annual grasses in well managed bluegrass; it is less effective in mediocre turf. Suggested rates are ¾ to 1 lb. of active ingredient per 1,000 sq. ft.

Betasan is an organic phosphate herbicide also known as bensulide. It controls annual grasses in established cool season turf. Reseeding should not be attempted for 4 months after application. Suggested rates are 12 lbs. active ingredient per acre or 5 lbs. of 5¾% granules per 1,000 sq. ft.

Dacthal has the common designation DCPA. It is especially effective on germinating grasses and also the seed of certain broadleaf species including chickweed and purslane. Dacthal is used extensively for weed control in ornamentals, small fruits, and in some farm crops. Do not use on new grass until after the first mowing. Reseeding to grass

should be delayed for 10 to 12 weeks after using. Suggested rate is 10 to 12 lbs. active ingredient per acre or 6 oz. of 75% wettable powder per 1,000 sq. ft.

Tupersan is a substituted urea compound known also as siduron. It effectively controls most annual warm season weedy grasses and has the unique quality of not interfering with the germination of newly seeded cool season perennial grasses which includes bluegrass. On established turf, use 10 to 12 lbs. of active ingredient per acre or 8 ozs. of 50% wettable powder per 1,000 sq. ft.

Postemergence Chemical Control

The application of weed killers to unwanted emerged plants is referred to as postemergence weed control. 2,4-D, dicamba, silvex, and other similar weed killers are selective postemergence herbicides. They selectively eliminate weeds and have little or no effect on desirable lawn grasses.

Many selective herbicides are growth regulators. They interfere with the normal processes within some plants by upsetting delicate hormone balances. These imbalances result in distorted growth and ruptured cells. Food movement is impaired and eventually death results.

Hormone-type herbicides, if not properly used, can cause injury or kill desirable flowers, shrubs, trees, and gardens. The more common postemergence herbicides include:

2,4-D (2,4-dichlorophenoxyacetic acid), a growth regulating hormone compound. 2,4-D is formulated principally as salts and esters and is sold under a wide variety of trade names. It is available as liquids, tablets, powders, wax bars and granules. The use of ester formulations should be avoided because of the hazards of fume damage to other plants in the vicinity.

2,4,5-T (2,4,5-trichlorophenoxyacetic acid) is similar to 2,4-D in makeup and action. It is more effective on some species such as wild rose, white clover, and horse nettle but less effective than 2,4-D on certain other species. 2,4,5-T is often

sold in combination with 2,4-D for chickweed and clover control.

Silvex (2,4,5-trichlorophenoxypropionic acid) is closely related to 2,4,5-T and is sometimes referred to as 2,4,5-TP. It is generally effective on the same species as 2,4,5-T and in addition is more effective on additional species.

MCPA (2-methyl-4-chlorophenoxyacetic acid) and **MCPP** or **mecoprop** (2-methyl-4-chlorophenoxypropionic acid) are herbicides similar to 2,4-D, silvex, and 2,4,5-T. At higher rates, they are less likely to cause noticeable adverse effects on grasses than similar rates of 2,4-D and silvex.

Dicamba (2-methoxy-3,6-dichlorobenzoic acid) is merchandised principally as Banvel-D. Its activity in plants is similar to the action of 2,4-D. It is more effective on clovers, chickweeds, and red sorrel than most other herbicides.

Dalapon (2,2-dichloropropionic acid) is sold under the trade name "Dowpon." It shows greatest activity on grasses and for that reason is used extensively in agriculture for weedy grass control in alfalfa and other broadleaf crops. Dalapon must be used as a "spot treatment" on clumps or patches of undesirable grass since it kills all grasses.

Arsonates are also known collectively as organic arsenicals. The principal products are DSMA (disodium methanearsonate), MSMA (monosodium acid methanearsonate) and MAMA (monoammonium methanearsonate). The arsonates are used to eliminate annual grassy weeds such as crabgrass and foxtail from perennial grasses and broadleaf species. They kill mostly by contact but also move within some plants to a limited extent. Arsonates have proven effective for nutsedge control.

Amitrole (3-amino-1,2,4-triazole) inhibits chlorophyll formation in plants. It is used for spot treatment to destroy undesirable plants and for total vegetation control.

Cacodylic acid (dimethylarsinic acid) destroys vegetation upon contact and is used for total vegetation control. Several applications are necessary for control of persistent

perennials such as bromegrass and tall fescue.

Herbicide Formulations

Proper use begins with selection of the proper weed killer and a safe formulation.

Postemergence weed killers are applied as liquids and solids.

Liquids—Esters and Salts

Liquids of the hormone type are normally esters or amine salts. Ester formulations may be low-volatile or high-volatile. Low volatile esters release a minimum amount of fumes at temperatures below 85° F.; high volatile esters give off fumes at lower temperatures. Air temperatures can be misleading since temperatures at the lawn surface may be 20 to 40 degrees higher.

No ester formulation is safe to use around ornamentals because of volatilization or vapor hazards. Salt formulations—lithium and amine—are less hazardous because they do not give off damaging fumes. However, wind movement of spray particles is equal on both esters and salts. Read labels carefully and select the very safest formulations and products available.

Under no condition should it be necessary for a homeowner to control weeds with highly toxic products. Such products bear the skull and crossbones and the word "Danger" on the label. Avoid their use.

Solids—Bars and Granules

Solid formulations commonly available are granules and wax bars. Both of these formulations provide effective weed control and reduce risk to desirable ornamentals and vegetable gardens.

Granular formulations work most satisfactorily when applied in late evening or early morning, when weed species are damp. Sprinkling with water before application also provides the necessary conditions for granular adherence and effective control.

Follow directions closely when using wax bar formulations. Temperatures above 85° F. can cause excessive application and "scorching" of the lawn grass.

Liquid Application

Liquid applicators can be classified into two groups—gravity flow and pressure.

Gravity Flow

Gravity flow liquid applicators are most desirable for the average homeowner. They are simple to operate, low in upkeep and initial cost, and eliminate fine droplets of spray which cause damage to ornamentals, fruits, and vegetables.

The simplest and least expensive gravity flow applicator is a plastic **sprinkle nozzle** that fits into a gallon jug. The jug is filled with the proper mixture of water and weed killer. When inverted, the mixture comes out in a uniform spray. Precision application can be obtained by first making a test run with water to determine the area covered at the normal walking speed.

Cane tubes equipped with a push type dispenser on the bottom end are popular for treating a few scattered weeds. Cane tubes are usually about 30" long. They are filled with water and herbicide. When the cane tube is pressed down on a plant, the dispenser releases a squirt of weed killer mixture. Pre-measured weed killer tablets are available for use in cane tubes;

however, liquid formulations will serve just as satisfactorily.

Liquid spreaders that work on the same principle as granular applicators are in the developmental stage. The most successful type employs a whirling disc which "throws" the weed killer mixture in a precision pattern.

"**Brush and can**" systems are convenient methods for treating small patches or a few individual plants. The herbicide mixture is simply "painted" or "daubed on" plants marked for elimination. The "brush and can" method works well for spot treating unwanted clumps or patches of grass. Use an inex-

pensive paint brush or a cloth or sponge dauber.

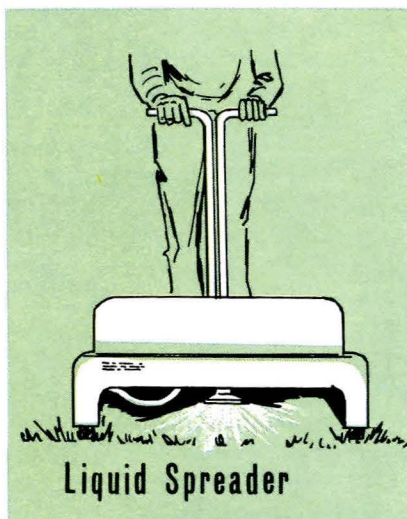
Pressure Systems

Pressure applicators are of two types—air pressure and water pressure. Air pressure sprayers require a sealed tank, pump, and nozzle. Water pressure sprayers are commonly known as "hose end" sprayers. They use water pressure to force distribution of the material.

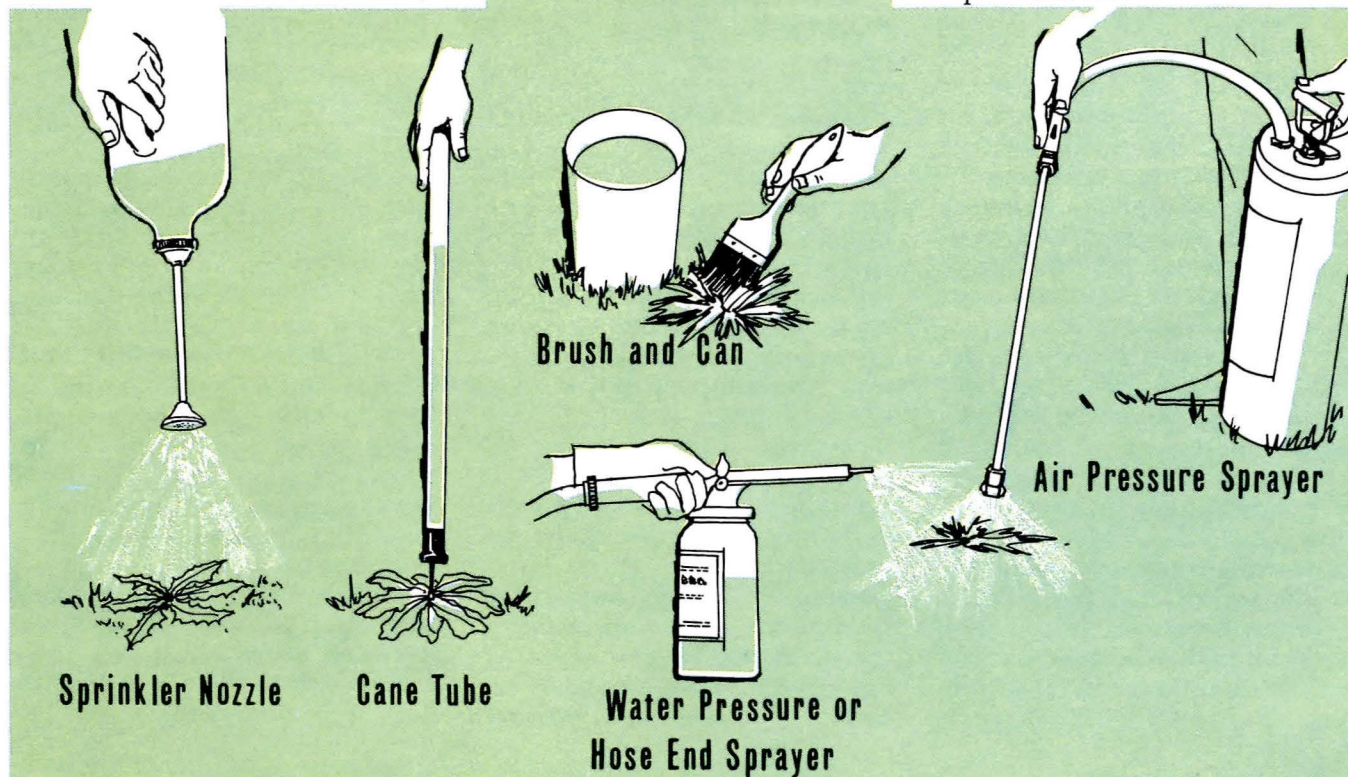
Misuse of pressure type applicators account for a considerable share of the weed-killer spray drift injury that occurs in urban neighborhoods. When using pressure sprayers, operate the equipment with as low a pressure as possible. Lower pressures increase spray droplet size and thereby reduce the possibility of drift. *Never operate pressure spray equipment in urban areas when wind movement is greater than 5 mph.*

The application of herbicides with hose-end units is difficult to control. Wrestling with the water hose and lack of precision placement with hose-end applicators makes for misapplication.

The use of gravity flow units is encouraged for herbicide use. Save hose-end units for the application of insecticides, fungicides, and liquid fertilizers.



Liquid Spreader



Sprinkler Nozzle

Cane Tube

Brush and Can

Water Pressure or
Hose End Sprayer

Air Pressure Sprayer

Table 1. Growth and treatment periods.

Weed	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Barnyard grass				■	■	■	■					
Bedstraw			■	■	■	■						
Black medic				■	■	■	■		■	■	■	
Bromegrass, smooth				■	■	■	■		■	■	■	
Chickweed common, mouse-ear			■	■	■	■			■	■	■	
Crabgrass				■	■	■	■					
Creeping bellflower				■	■	■	■		■	■	■	
Dandelion				■	■	■	■		■	■	■	
Dock				■	■	■	■		■	■	■	
Field bindweed				■	■	■	■		■	■	■	
Foxtail, green, yellow				■	■	■	■					
Goosegrass				■	■	■	■					
Ground ivy				■	■	■	■		■	■	■	
Henbit				■	■	■	■		■	■	■	
Kochia				■	■	■	■					
Mallow				■	■	■	■					
Moss				■	■	■	■		■	■	■	
Musk thistle				■	■	■	■		■	■	■	
Nimblewill				■	■	■	■					
Pennycress				■	■	■	■		■	■	■	
Plantain				■	■	■	■		■	■	■	
Prostrate knotweed			■	■	■	■	■					
Prostrate pigweed				■	■	■	■					
Prostrate vervain				■	■	■	■					
Puncturevine				■	■	■	■					
Purslane				■	■	■	■					
Quackgrass				■	■	■	■		■	■	■	
Red sorrel				■	■	■	■		■	■	■	
Sandbur				■	■	■	■					
Shepherd's purse				■	■	■	■		■	■	■	
Speedwell				■	■	■	■		■	■	■	
Spurge, prostrate ^a				■	■	■	■					
Tall fescue				■	■	■	■		■	■	■	
Violet				■	■	■	■		■	■	■	
Waterleaf				■	■	■	■					
White clover				■	■	■	■		■	■	■	
Yellow nutsedge				■	■	■	■					
Yellow woodsorrel				■	■	■	■					

■ = Active period of plant growth varies from year to year and from NW to SE

■ = Apply preemergence chemicals

■ = Apply postemergence treatments. Approximate periods may vary two weeks from season to season and from NW to SE in Nebr. Use granular or wax bar formulations of 2,4-D, Banvel D, Silvex, and 2,4,5-T between May 1 and September 15.

^a Preemergence herbicide applications should be made a second time in late June or early July.

Table 2. Weed response to herbicides.

Weed	Preemergence ^a control	Postemergence control ^b	
		1st choice	2nd choice
Barnyard grass	Yes	Arsonates	
Bedstraw	No	Silvex	Banvel-D
Black medic	No	Silvex	Banvel-D
Brome-grass, smooth	No	Banvel-D ^c	Dalapon ^d
Chickweed Common, mouse-ear	Some	Banvel-D, Silvex	
Crabgrass	Yes	Arsonates	Kerosene ^e
Creeping bellflower	No	Banvel-D	
Dandelion	Seedlings	2,4-D	
Dock	No	Banvel-D	2,4-D
Field bindweed	No	2,4-D	Banvel-D
Foxtail green, yellow	Yes	Arsonates	
Goosegrass	Yes	Arsonates	
Ground ivy	No	Silvex	Banvel-D, 2,4-D
Henbit	No	Silvex	Banvel-D
Kochia	No	2,4-D	
Mallow	No	2,4-D (Fair)	
Moss	No	Cu So ₄ ^f	
Musk thistle	No	2,4-D	
Nimblewill	Seedlings	Arsonate + 2,4-D ^g	Dalapon ^d or amitrole ^d 1/4 #/gal.
Pennycress	No	2,4-D	
Plantain	No	2,4-D	
Prostrate knotweed	March	Banvel-D	2,4-D (early)
Prostrate pigweed	Some	2,4-D	Banvel-D
Prostrate vervain	No	2,4-D	
Purslane	Benefin, Dacthal	Banvel-D	Silvex
Puncturevine	No	2,4-D	Oil (wet plants)
Quackgrass	No	No selective chemical	Spot treat with dalapon ^d
Red sorrel	No	Banvel-D	
Sandbur	No	Arsonates	
Shepherd's purse	No	2,4-D early	2,4,5-T
Speedwell		Dacthal ^h	
Spurge, prostrate	Some ⁱ	Banvel-D	Silvex
Tall fescue	No	Dalapon ^d	
Violet	No	Silvex	
Waterleaf	No	Silvex	
White clover	No	Banvel-D	Silvex
Yellow nutsedge	No	Arsonates	
Yellow woodsorrel	Seedlings	Banvel-D	Silvex

^a See Pages 16-17 for discussion of herbicides commonly sold for preemergence control. Products are listed where superiority has been noted on specific weeds. Follow manufacturer's recommendations on rates.

^b Follow manufacturer's recommendations on rates. Use wax bars and granular formulations of 2,4-D, Banvel-D, 2,4,5-T, and silvex between May 1 and September 15 to reduce danger of herbicide drift and injury to trees, shrubs, and gardens.

^c Treat individual plants. Do not spray entire lawn. Use 6 tablespoons Banvel-D concentrate per gallon of water and apply as a wetting spray.

^d Treat individual plants. Do not spray entire lawn. Dalapon and amitrole kill all grasses.

^e 1 quart of water-white kerosene per 100 square feet.

^f 1 ounce copper sulfate per gallon of water to 200 square feet.

^g Arsonate at heaviest crabgrass control rate, 2,4-D amine at dandelion rate. Make three treatments 10 days apart.

^h Preliminary results favorable. Use 6 ounces Dacthal 75W per 1,000 square feet.

ⁱ A second preemergence treatment in late June or early July would be beneficial.

Appendix 1

Selective Postemergence Weed Killers And Their Active Ingredient Content

(L) = liquid; (G) = granules; (SP) = soluble powder;
(WP) = wetttable powder

A. Dicamba (Banvel D)

1. Colorado's Own Chickweed And Clover Killer (L)
2. Colorado's Own Spot Clover Killer With Fertilizer (G)
3. Scotts ProTurf K-O-G Weed Control (G)
4. Velsicol Banvel D 4S (L)

B. Dicamba (Banvel D) and 2,4-D

1. Amchem Super D Weedone (L)
2. Amchem Super D Weedone Foam Weed Killer (Aerosol)
3. Balcom Clover Killer (L)
4. Borden Nutro Turf Weed Killer (L)
5. Borden Nutro Weed And Feed With Fertilizer (G)
6. Colorado Nurserymen's Dandelion And Weed Killer (L)
7. Colorado's Own Dandelion and Weed Killer (L)
8. Colorado's Own Weed And Feed With Fertilizer (G)
9. Coop Banvel D/2,4-D Lawn Weed Killer (L)
10. Ferti-Lome Broad Spectrum Weed Killer (L)
11. Ferti-Lome Weed And Feed (G)
12. Gordon Chemical Super 6 (L)
13. Earl May "May Way" (L)
14. MFA Lawn Weed Killer (L)
15. Millers Broadleaf Lawn Weed Killer (L)
16. Ortho Super Lawn Groom with fertilizer (G)
17. Ortho Weed-B-Gon (L)
18. Science Products Lawn Weed Killer (L)
19. Scotts Kansel Weed Control (G)
20. Scotts ProTurf with fertilizer (G)
21. Scotts Turf Builder Plus 2 and Plus 4 with fertilizer (G)
22. Sears Weed Killer (Aerosol)
23. Swift's Deep Green Vigoro Weed and Feed with fertilizer (G)
24. Swift's Vigoro Chickweed And Clover Killer (G) (L)
25. Swift's Vigoro Chickweed, Clover, and Weed Killer (G)
26. Vaughans Feeder Weeder with fertilizer (G)
27. Velsicol Banvel D + 2,4-D (L)

C. 2,4-D

1. Chipman's Chipco Turf Herbicide "D" (L)
2. Chipman's Weedez Wonder Bar
3. Diamond Alkali Dacamine (L)
4. Encap "Pop-In" Weed Control Spray with Lithate (SP)

5. Heritage House 'Systemic' Dacamine (L)
6. Ortho Weed-B-Gon Bar
7. Sacco Wëdō with fertilizer (G)
8. Thompson-Hayward Ded-Weed 40 (L)
9. Vaughans Weed Control (G)

D. 2,4-D and MCPP (Mecoprop)

1. Chipman's Chipco Turf Eleen (L)
2. Heritage House 'Systemic' Dandelion And Chickweed Killer
3. Morton's Mecopar (L)

E. 2,4-D and Silvex

1. Acme "Weed-No-More" Granules (G)
2. Acme "Weed-No-More" Lawn Weed Killer (L)
3. Amchem Lawn Weed Killer (G)
4. Amchem Weedone Lawn Weed Killer (L)
5. Amchem Weedust (Powder)
6. Greenfield Dandelion and Broadleaf Weed Killer (G)
7. Greenfield Dandelion and Chickweed Killer (L)
8. Henry Field's Liquid Lawn Weed Killer with Silvex (L)
9. Heritage House Lawn Weed Killer Aerosol
10. Heritage House 'Systemic' Weed and Feed plus fertilizer, insecticide (G)
11. Killer Kane Dandelion Broadleaf Kartridges
12. Nutro Golf Green Weed and Feed (G)
13. Nutro Kills Lawn Weeds (G)
14. Nutro Turf Weed Killer (L)
15. Woodbury Lawn Weed Killer (L)

F. 2,4-D and 2,4,5-T

1. Amchem Weedone Brush Killer 32 (L)
2. Black Leaf Lawn Weed Bomb
3. Black Leaf Lawn Weed Killer
4. Chipman's Chipco Turf Herbicide D & T
5. Greenfield Two-Way Green Power with fertilizer (G)
6. Gordon's Lawn Weed Killer (L)
7. Ortho Brush Killer (L)
8. Ortho Poison Ivy Killer
9. Thompson-Hayward Ded-Weed For Lawns (L)
10. Vaughans Lawn Weed Killer (L)

G. 2,4,5-T

1. Amchem Weedone Clover Killer (L)
2. Chipman's Chipco Turf Herbicide "T" (L)
3. Vaughans Lawn Clover Killer (L)

H. Silvex (2,4,5-TP)

1. Acme Chickweed Clover Killer (L)
2. Amchem Weedone Chickweed Killer (L)
3. Black Leaf Clover And Chickweed Killer (Aerosol)
4. Chipman's Silvex 4L (L)
5. Coop Silvex Lawn Weed Killer (L)
6. Gordon's Chickweed And Clover Killer (L)
7. Heritage House Chickweed And Clover Killer Aerosol

8. Ortho Chickweed And Clover Killer (L)
9. Vaughans Bentgrass And Chickweed Killer (L)

J. Other Herbicides and Combinations for Postemergence Weed Control

1. Chipman's Chipco Turf Herbicide MCP (L)
2. Greenfield Dandelion And Broadleaf Weed Killer (Aerosol) with 2,4-D, Silvex and 2,4,5-T
3. Heritage House 'Systemic' Crabgrass Broadleaf Weed Killer, 2,4-D and arsonate (L)
4. Heritage House 'Systemic' Lawn Weed Control with 2,4-D, MCP or Silvex and arsonate (G)
5. Morton's Mecopex with MCP (L)
6. Ortho Weed-B-Gon Spot Weeder (Aerosol) with MCP, 2,4-D, and 2,4,5-T
7. Vaughans K. O. with Sodar (arsonate) and 2,4-D (G) or (L)

K. Arsonates (DSMA) (MSMA) for annual grasses and nutsedge

1. Acme Crabgrass Killer (L)
2. Amchem Weedone Crabgrass Killer "Sodar" (L) and (G)
3. Ansul Ansar 529 (L)
4. Black Leaf Crabgrass Killer (L)
5. Coop DSMA Crabgrass Killer (L)
6. Ferti-Lome Nutgrass And Weed Killer (L)
7. Ferti-Lome Ready-To-Use Weed And Wild Grass Killer (L)
8. Gordon's Selective Crabgrass Killer (L)
9. Miller's Liquid Crabgrass Killer (L)
10. Ortho Crabgrass Killer (L)
11. Scotts Clout (G)
12. Shelley Selectar No. 1 (L)
13. Vaughans Super Sodar (L)

Appendix 2

Preemergence Weed Killers and Active Ingredient Content

A. Arsenates

(Danger: Calcium arsenate and lead arsenate are highly toxic to humans and animals. They must be handled with extreme care. Containers are labeled with the skull and crossbones)

1. Chipman's Chip-Cal Granular Calcium Arsenate (G) and Powder
2. Chipman's Chipco Hi-Test Lead Arsenate
3. General Chemical Granular Calcium Arsenate
4. Pax Crabgrass Control (3-yr. program) (lead arsenate)
5. Vaughans Pre-Kill (calcium arsenate) (G)

B. Azak

1. Agrico "Homestead Line" for crabgrass (G)
2. Hercules Azak 80 WP
3. Hercules Azak 5% Granules
4. Sear's Crabgrass Control (G)

C. Benefin (Balan) and Trifluralin (Treflan)

1. Elanco Balan Granular
2. Greenfield Crabgrass and Broadleaf Weed Killer with arsonate, treflan, 2,4-D, and 2,4,5-T (L) and (G)
3. Greenfield Crabicide-Balan (G)
4. Greenfield Triple Action with fertilizer and insecticide-Balan (G)

D. Bandane

1. Ferti-Lome Triple Action (G)
2. Gordon's Bandane Crabgrass Killer (G)
3. Huebner's Lawn Fertilizer For Crabgrass Control (G)

4. Lincoln Triple Turf Tonic (G)
5. Manco B-4 Preemergence Crabgrass Control (G)
6. Earl May's Lawn Doctor (G)
7. Scotts Halts (G)
8. Scotts Halts Plus with fertilizer (G)
9. Scotts ProTurf fertilizer IV (G)
10. Swift's Vitagro Triple-Acting Crabgrass Control (G)
11. Thompson-Hayward De-Pester Bandane Plus (G)
12. Velsicol Bandane (G)

E. Bensulide (Betasan)

1. Colorado's Own Betasan
2. Mallinckrodt Pre-San
3. Northrup King Golf Brand Crabgrass Killer (G)
4. Ortho Crabgrass Control with insecticide and fertilizer (G)
5. Scotts Turf Builder Plus 4 (G)
6. Stauffer Betasan (G)

F. DCPA (Dacthal)

1. Acme Garden Weed Preventer (WP and G)
2. Armour Vertagard (G)
3. Armour Vertagreen (G)
4. Balcom Balcite Special (G)
5. Borden Nutro Crabgrass Weed Killer and Turf Food (G)
6. Borden Nutro Golf Green Crabgrass and Insect Control with fertilizer (G)
7. Borden Nutro Crabgrass and Insect Control Turf Food with Aldrin (G)
8. Coop Big 3 Lawn Fertilizer with insecticide (G)
9. Diamond Alkali Dacthal 5G (G)

10. Diamond Alkali Dacthal W50 and W75 (wettable powder)
11. Ferti-Lome Spring Crabgrass Preventer (G)
12. Gibson's Mr. Turf (G)
13. Gordon's Stopit (G)
14. Henry Field's New Crabgrass Killer For Spring (G)
15. Heritage House Dacthal Plus Three on fertilizer and insecticide (G)
16. Heritage House Garden Weed Preventer (WP and G)
17. Miller's Cinch with fertilizer and insecticide (G)
18. Pax Total with 2,4-D, MCP, arsonates and insecticides
19. Philgro Crabgrass Preventer on 10-6-4 Fertilizer (G)
20. Swift's Rid (G)
21. Swift's Vitagro (G)
22. Vaughans Four Way with fertilizer and insecticide (G)
23. Vaughans Pre-Vents
24. Woodbury Lawnguard with fertilizer and chlor-dane (G)

G. Siduron (Tupersan)

1. Agrico 1-2-3 with fertilizer and insecticide (G)
2. Agrico Preemergence Crabgrass Control (G)
3. Amchem Crabgrass Killer (L)
4. Dupont Tupersan (WP)
5. Greenfield Triplex with fertilizer and insecticide (G)
6. Heritage House Crabgrass Preventer plus Three with fertilizer and insecticide (L)
7. IMC "Thrive"
8. Montgomery Ward Garden Mark Crabgrass Control (G)
9. Nutro Spring Seeding Special Crabgrass Control with fertilizer (G)
10. Pax Full Season with fertilizer (G)

Appendix 3

Combinations of Postemergence and Preemergence Weed Killers With Active Ingredient Contents

1. Scotts ProTurf Fertilizer IV, Banvel-D and Bandane (G)
2. Scotts Turf Builder Plus 4 with Betasan, 2,4-D, Banvel-D, and insecticide (G)
3. Pax Total with Dacthal, 2,4-D, MCP, arsonate and insecticide (G)

Appendix 4

Products for Grass or Total Vegetation Control and Their Active Ingredients

A. Amitrole

1. Amchem Weedone Poison Ivy Killer (aerosol and liquid)
2. Amchem Weedone Spot Grass and Weed Killer (aerosol)
3. Amchem X-all with simazine (L and G)

B. Cacodylic Acid

1. Ansul Phytar 560 (L)
2. Scotts Erase (G)
3. Shelley Non-Selectar No. 15 (L)

C. Dalapon

1. Dowpon Grass Killer Bar
2. Dowpon Grass Killer (SP)
3. Vaughans Grass Killer Bar

D. Sodium Arsenite

(Danger: Sodium arsenite is highly toxic to humans and animals. A few drops can be fatal. All containers bear the skull and crossbones)

1. Acme Weed Killer Soil Sterilant (L)
2. Black Leaf Total Weed Killer (L)
3. Ortho Triox Weed Killer (L)
4. Reade Herbicide (L)

E. Other

1. Acme Vegetation Killer with Prometone and 2,4-D
2. Diquat
3. Ferti-Lome Perma-Trim
4. Paraquat
5. Ortho New Improved Triox



Use Pesticides Safely
FOLLOW THE LABEL

- Identify your weed problem.
- Select the proper weed killer for the job and season (Table 2 and Appendix). Consider safety to humans, pets, lawns, and ornamentals.
- Study the container label, accompanying literature, and bulletins.
- Carefully check weather conditions.
 - temperature (see page 17).
 - wind velocity and direction (page 17 and 18)..
- Consult with neighbors before making application.
- Apply exactly as directed.
- Clean up afterwards
 - wash exposed portions of the body
 - clean equipment.
- Safely dispose of empty containers.
- Keep and store all pesticides in their original labeled containers out of the reach of children and irresponsible adults.