WEEDS and TURF

OCTOBER 1963

Monthly news for contract sprayers of weeds, turf, ornamentals, and trees

1963 Chemical Suppliers Guide Issue

page W-18

Complete Manual of Aquatic Weed Control Begins This Month . . W-8

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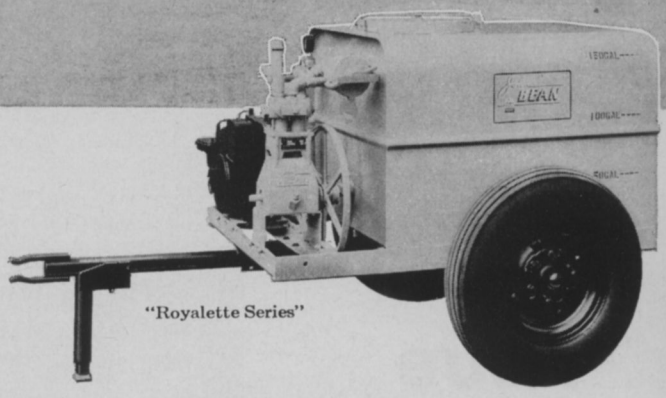

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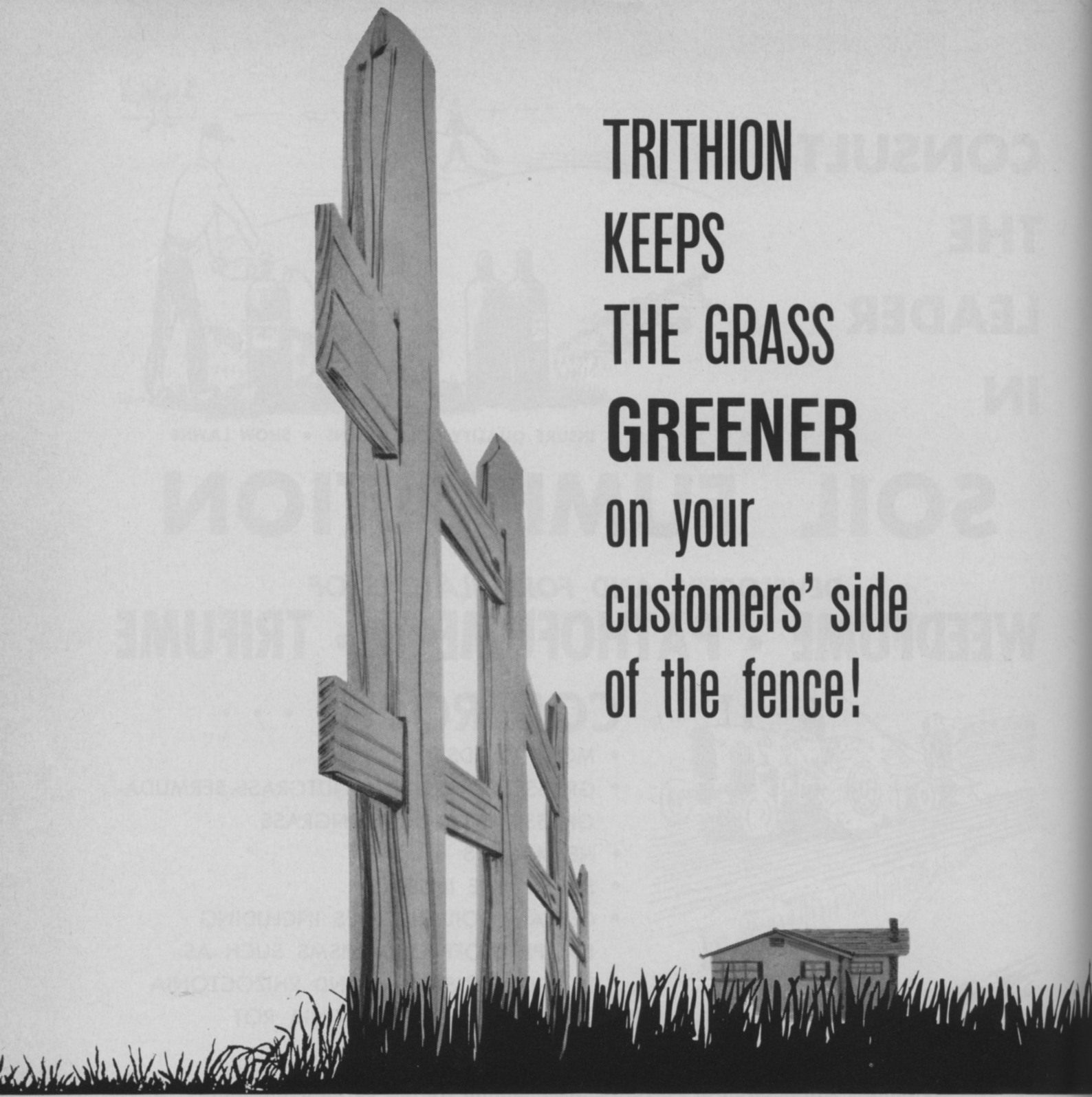

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A SECTION OF PEST CONTROL MAGAZINE

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Speak up now!

Applicators of chemicals for weed control and turf and tree maintenance are currently being swamped with legislation.

From the far corners of the country, with increasing frequency, this magazine receives reports that contract applicators face more and more restricting laws about the use of chemical pesticides.

Astute industry observers will no doubt agree that once the pesticide question caught the public eye, such a rash of new laws was to be expected.

What is alarming to veteran applicators, however, is the fact that too many of the new restrictions are being recommended without consultation with the people who really understand *all* aspects of the pesticide problem. Who is better qualified to speak about the use of pesticides than the contract applicator who makes his living in constant proximity to the compounds some people fear?

We do not doubt that most critics of this chemical age are well-meaning folks who are unduly apprehensive or just misinformed. Some "authorities," qualified in their own fields, may not have the last word on the real or imagined dangers of pesticides. A skilled MD with a good bedside manner is not necessarily a toxicologist.

Because of the danger of unqualified guidance, we recommend that every applicator make himself heard in town hall forums, in state hearings, through local papers, and everywhere possible. Laws meant to govern CAs should not be passed without the good counsel of the governed.

There was once a revolution fought on these shores because a people refused to be taxed without fair representation. It would indeed be a sad comment on the industry if educated, experienced leaders fail to speak up now, in order to give lawmakers a truly proper perspective.

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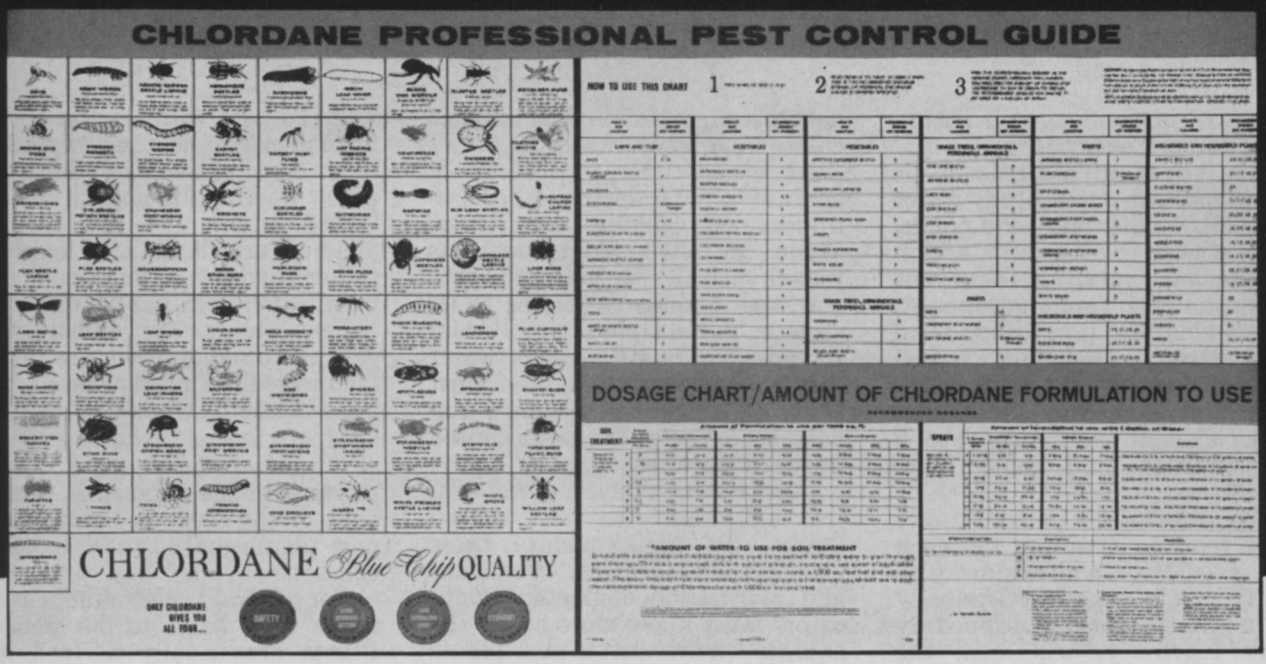

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Biology and Identification of Aquatic Weeds

Results of another *Weeds and Turf* field research project

MAN IS in conflict with nature at almost every turn.

This fact is no less true in his use of natural or artificial water bodies. In smaller lakes and ponds, where there is no wave action or water level variation to prevent vegetation from running rampant, there is a natural progression from open water to shallow water, through various stages of vegetation, to a swamp or marsh stage. This, in turn, leads to a bog condition, and finally back to land.

This observable pattern takes many years to complete, but each year, vegetation whittles away at waters man finds useful. Gradually the progression, if not stopped by man's ingenuity, will steal the carefully cultivated usefulness of lakes and ponds.

Lakes are harnessed for food, recreation, transportation, flood control, electrical power, and water supply. Other waters, such as canals and ditches, are used for irrigation, drainage, and transportation. Aquatic weeds in these waterways annually cost millions of dollars, money which is spent to forestall, halt, or set back nature's progression that aims to create land where water is.

At other times, outbreaks of aquatic plants destroy the usefulness of existing waterways. When an alien plant, such as waterhyacinth, is released into new surroundings favorable to its growth, it multiplies rapidly and spreads over many acres of water surface. In these cases, man must attempt to correct nature's imbalance, or suffer the losses caused by weed growths.

Markets for aquatic weed control exist all over the United States. To accommodate these markets with service, chemicals, and information, competent applicators must know more about the aquatic environment and plants they want to control. This three-part series will deal with aquatic plant biology and identification, chemicals used for control, and application equipment and techniques.

Aquatic World is Unique

An aquatic environment is a different world from that which is familiar to man. Weeds must be destroyed selectively; desirable animals and fish inhabitants must live. To deal with an aquatic environment, a new set of factors must be considered in addition to plant species: biological factors (waxy cuticle on leaves), pH (acidity or alkalinity), hardness (mineral content), or organic content, currents, control period (when plants are killed most easily), to name just a few. These factors will be mentioned as they arise in the discussion.

Most logical sequence for a study of aquatic weed control starts with the organisms. Knowledge of the form and function of pest plants makes them easier to control.

For general background, certain terms will have to be defined. Plants are usually divided into two arbitrary groups: higher and lower. *Higher plants* are thought of as more advanced on an evolutionary scale. It is generally assumed that some plants came from ancient seas when land became habitable. The flowering habit evolved on land. Since higher plants have flowers, and some aquatic plants have flowers, they are thought to have been evolved from plants which formerly lived on land and readapted to water after developing the flowering-seed habit.

Lower plants are those which never left water in the course of their development. Algae are the most widespread representatives of this group.

Lower plants, which do not flower, have a vegetative growth pattern. Some lower plants, such as algae, grow by cell division; each two new cells are exactly like the original. There are other groups of lower plants which have more advanced growth patterns and unusual methods of reproduction.

Higher aquatic plants, since they are derived from land plants, have similar life cycles. They sprout from seeds, grow to maturity, develop flowers, and produce seeds. Some of the more troublesome aquatic weeds are perennial plants.

Perennials are long-lived, higher plants which resprout each year from tubers, underground rhi-

Controversy over the use of chemical pesticides has insured 1963 an important niche in the chronicle of modern weed control practices, and nowhere is the need for safety and technical proficiency more obvious than in aquatic weed work. For this reason, *Weeds and Turf* is proud to present the first in a three-part series of articles designed as a working manual for aquatic weed controllers.

Part I deals with growth habits and ecology of aquatic species; Part II, which appears next month, discusses chemicals in detail; Part III, slated for December, explains equipment which is used to apply controls. Included with the final installment will be an extensive bibliography.

This three-part report was prepared by W&T's technical staff and then circulated among leading authorities with university and government agencies, and with suppliers. The reviewers have been most thorough and painstaking in their comments, and we wish, at the outset, to publicly acknowledge their help.

Unless otherwise noted, photographs are from the Plantation Field Laboratory of the U. S. Department of Agriculture in Ft. Lauderdale, Fla., with the cooperation of staffers Lyle W. Weldon and R. D. Blackburn. — *Ed.*

zomes, or stolons (rootlike stems); seeds are not necessary to carry on the species, but contribute to the spread of perennial weeds. Weeds which choke waterways with thick, matted growth are often perennials.

Second Grouping System

A second grouping system used by aquatic plant experts is a separation with respect to how weeds are found in the water, for this often determines the control method to be used.

If plants are found completely under water, they are called *submersed aquatic plants.* This distinguishes those plants naturally found under water from those which are submerged when flooded or inundated.

Plants found protruding significantly from the water, such as cattail, are called *emersed aquatic plants.*

Floating weeds, such as waterhyacinth and duckweed, which are not rooted but may protrude above the water line, are called *surface aquatics,* or *unattached-floating plants.* Species which are rooted and have an "anchored" leaf or "pad" are called *attached-floating aquatic plants.* Some variation may be found if authors wish to designate whether emersed parts have leaves, flowers, or branches.

To describe where aquatic plants are found, we can use a division from ecology (Odum, 1959). Of three zones of a lake, *littoral* (marginal or closest to shore), *limnetic* (served by sunlight but over deep, open water), and *profundal* (beneath the limnetic; not furnished with light), the first, littoral, is the most important. It is in shallow littoral zones where all rooted and most floating vegetation is found. Where the littoral zone may be affected by rising and falling water lines, some "amphibious" plants may live both on land and in water (Hall, 1961).

After the plants are placed and different growth habits defined, one can concentrate on specifics about aquatic plant pests.

There are 25 families covering some 185 species of plants classed as aquatic weeds. This article will include habits, identification, and distribution of the most important of these families. Names of species are in accord with the Report of the Terminology Committee of the Weed Society of America (1962). First to be considered are those emersed species with parts protruding above the surface.

Cattails Are First Invaders

A most familiar emersed species is cattail, *Typha* spp., family Typhaceae (family suffix -ceae; tie fay′ sea ee). Cattail is found throughout the United States, and is easily recognized by its tall, slender leaves, and tannish-brown flower spike. Cattail is usually the first rooted vegetation to invade shallow margins of a man-made farm pond; it grows in any wet place where its airborne seeds may land and germinate. Cattail colonies are formed from a fast-spreading underground root system. These stems and roots catch and hold soil firmly and begin to fill in pond margins and drainage canals. A stand of cattail can significantly reduce the perimeter distance of a pond in a short time. Cattail is found in fresh water, but will tolerate brackish waters of coastal marshes. (Muenscher 1944).

Bulrush Not Rush

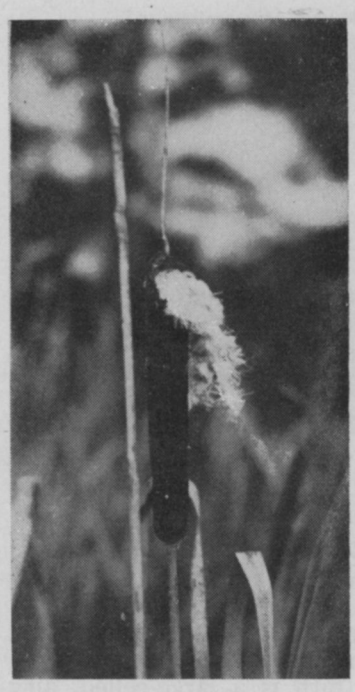
Another slender-leaved emersed species is bulrush, *Scirpus* spp. *Scirpus* is a member of the sedge family, Cyperaceae; it is not a true rush. Bulrushes are generally characterized by rounded or three-angled stems. Insides of stems are solid, contrasted with true rushes which have round and hollow, or nearly hollow, stems. The point where a leaf joins the bulrush stem is covered by a leaf sheath.

Many bulrushes are tall, 3 to 5 feet above water, sprouting from sturdy rootstocks. Reproductive parts are nutlike or conelike seeds borne near the end of an erect shoot. Seed clusters may sit directly on the naked stem or may hang on a branched spikelet, depending upon the species.

Two species of bulrush are especially troublesome across the United States, hardstem bulrush or tule, *Scirpus acutus,* and great or softstem bulrush, *Scirpus validus.* Both have solid circular stems and spikelets (seeds) borne on a branch or panicle, as it is called. Groups of nutlike spikelets of hardstem bulrush are ovate or rounded, while softstem bulrush has spikelets more pointed or lanceolate. A small portion of the main stem extends above seed clusters in both species.

There are many other species of bulrush distributed throughout the United States. They are recognized by a rounded or triangular stem, sheathed leaf

Rush (*Juncus* sp.) Staff photo.



Common cattail (*Typha latifolia*)

Watermilfoil (*Myriophyllum* sp.) Staff photo.

Burreed (*Sparganium* sp.) Staff photo.

Alligatorweed (*Alternanthera* sp.)

bases, and the subterminal nature of reproductive structures.

True Rushes

Commonly confused with sedges are true rushes, *Juncus* spp. (Juncaceae). Rushes can be spotted by a round, hollow, or pith-filled stem (pith is a large-celled, airy or spongy tissue). Species of *Juncus* are adapted to grow in shallow pond margins and along stream edges. Rushes commonly do not grow as high as some sedges. Usually found in grasslike clumps, most rush species do not have extensive underground roots from which to sprout new plants. Reproductive parts are not nutlike as sedges, but bear seeds on subterminal branchlets. Seeds are smaller with subtending stiff hairy parts.

Keep "Reeds" Straight

A so-called reed or reedlike species is burreed, *Sparganium* spp. (Sparganiaceae). Burreeds are widespread throughout the United States.

Leaves of burreed are of two types, erect or floating. Several species have limp leaves which float on top of the water; others stand up, typical of reedlike species. The character of burreed which serves for identification is the bur-type seeds borne on an erect, leafless, crooked stem. Parts of female flowers persist to form stiff hooks on seed clusters; this gives burreed its name, although it is not generally like a reed.

Giant reed, *Phragmites communis*, is the true reed of marshes, lakes, and ditchbanks. It is a perennial with hard, jointed, erect stems. Roots are coarse and scaly. Giant reed may grow to a height of 12 feet and be topped with the large feathery head of seeds. Growth is often so thick and hedgelike that access to the water is hindered (Klingman, 1961).

The time of chemical application which will give maximum control is an important factor when dealing with giant reed. When giant reed, which usually grows on land, becomes inundated with water, it becomes particularly resistant to herbicides which normally control it. The control period, or time span within which the weed can be more easily controlled, is significantly reduced.

Alligatorweed, *Alternanthera philoxeroides*, is a southern resident which was imported from South America. It is prominent in the Gulf States, and southeast coastal areas. Alligatorweed is a hardy weed which grows well as a floating, rooted, or dry land plant. Plants on land or rooted in shallow water arise from relatively stout rootstocks. Plants in floating mats have only fibrous roots arising from stem joints. Stems are erect, with opposite leaves at regular intervals. Leaves are long, tapering to a point (lanceolate); leaf edges are smooth. Many tiny white flowers are on a head which arises either from a terminal shoot or long straight petioles from axils of uppermost leaves. Seeds of alligatorweed are seldom found; this weed propagates mainly by spreading roots or stem shoots, each of which may sprout and grow a new colony (Weldon 1962). It easily forms a mat from the shoreline over all shallow open water. Other plants are crowded out by this persistent growth habit.

"Arrowheads" Can Confuse

Three different aquatic weeds have arrow-shaped leaves which can confound hasty identification. A close look confirms that these three species are different in the way the veins are placed in leaves. Once noticed, this difference is not difficult to see.

Arrowarum, *Peltandra virginica*, is a member of the same family (Araceae) as the terrestrial Jack-in-the-Pulpit and skunk cabbage. As such, arrowarum has a flower spike (spadix) which is enclosed in a wraparound leaf (spathe). Arrowarum has three distinct leaf veins radiating from the petiole attachment. One vein goes to the tip, the other two go to the basal points (arrow barbs). Secondary veins branch off horizontally from the midrib. Margins of arrowarum are sometimes wavy or uneven.

Pickerelweed, *Pontederia cordata*, is another erect emersed species which has arrow-shaped leaves. In the family Pontederiaceae, of which waterhyacinth is also a member, pickerelweed, with exposed purple flowers, is distinguished from arrowarum when flowering. When not in flower, leaves of pickerelweed differ in that there is no main vein or midrib. All veins originate at the petiole attachment and travel singularly to the tip. Veins are curved into the lobe portions of this "arrowhead."

Most familiar genus in the waterplantain family, Alismaceae, is arrowhead or duck potato, *Sagittaria* spp. Arrowhead is common and widespread throughout the country.

Flowers of arrowhead are distinctive. They are borne on a tall stalk, usually in groups of three about a stem. Flower structure is simple; there are three small, white, or sometimes pink, petals. Several groups of three will be found at different levels on the erect stem. Stems of water plantains are fleshy and have a milky juice. Although leaf shape varies from one species of *Sagittaria* to another; (some are broad; others very slender), they retain an arrowhead shape. At times species have two different kinds of leaves on one plant; one kind above water and one below. Submersed leaves are usually slender and ribbonlike.

Venation will help distinguish *Sagittaria* from other "arrowhead" plants. Veins of *Sagittaria* are parallel, similar to those of terrestrial plantains. There is no strong midrib; veins which supply nourishment to basal lobes are branches of those which run to the tip.

Sagittaria is considered a valuable food plant for waterfowl, and is often introduced into a lake for duck food (Fassett 1960). Ducks

relish the tuberous roots of some species of arrowhead, hence the common names of duck potato or swamp potato are used in some parts of the country.

Water smartweed, *Polygonum amphibium*, is a member of the buckwheat family, Polygonaceae. The quickest way to confirm identification of a smartweed, when a pink, white, or greenish flower spike is seen along with alternating lanceolate leaves, is to check the jointed stem. If there is a sheath or stem extension at the base of each leaf petiole covering each joint or node, it is a *Polygonum*.

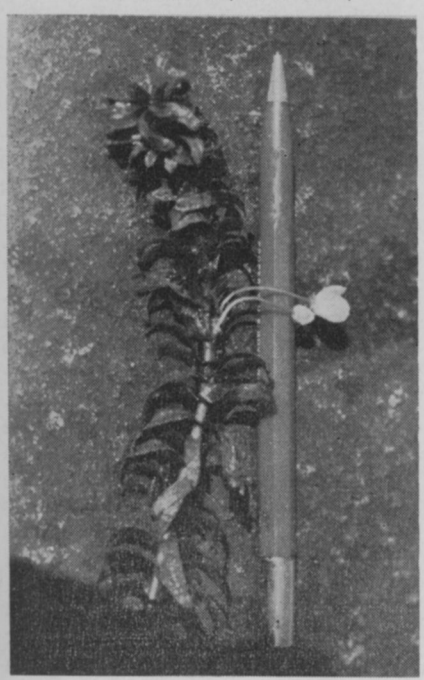
Smartweed species are generally distributed over the United States.

Waterprimroses, *Jussiaea* spp., are members of the evening-primrose family, Onagraceae. Waterprimrose is a rooted emergent genus. Species of waterprimrose (*J. repens* var. *glabrescens*, *J. californica*, and *J. grandifolia*) form mats of vegetation due to the air-holding capacity of stems. Roots are embedded in marginal shallow areas, and vast mats spread outward from the shoreline. Leaves are willowlike; long and slender. Flowers have 5 yellow petals, and are borne in the axils of leaves. The fused petals form a long tube connecting the flower stalk with the open petals. The ovary is long and slender and produces many seeds. Waterprimrose has an underground stem which sends up new shoots intermittently.

Waterwillow, *Justicia* (*Dianthera*) *americana*, (An alternate genus or species in parentheses indicates that either name may be found in texts depending upon date of publication. The first name is preferred.) has leaves similar to true willows (*Salix* spp.), but waterwillow, being herbaceous in nature, is not related to the woody species. This member of the family Acanthaceae is widespread throughout the eastern half of the United States.

Waterwillow is a perennial with thick creeping rootstocks. It reaches a height of about 5 feet. Leaves are willowlike, opposite on the stem and entire (not toothed or scalloped around the edges). Flowers are purple. Waterwillow is found nearer the edge of a lake or pond and does not spread lakeward. It can also survive out of water, but thrives when partly submerged.

Brazilian elodea (*Elodea densa*)



Submersed Weeds: Anathema To Boaters, Swimmers, Fishermen

Submersed aquatics are the second group of important weeds. These weeds usually grow entirely under water, but leaves may reach the surface when growth is dense. They may or may not be rooted. Submersed aquatics do not have enough supporting tissue in their stems to maintain an erect posture out of water. Many submersed species do develop short flower stalks which may extend above the water surface for fertilization. This is an ephemeral occurrence and reproductive parts usually bend into the water after pollination.

Submersed weeds are the most troublesome group of aquatic plants that occur in irrigation and drainage ditches. Underwater weeds clog waterways, collect silt, and reduce flow to agricultural fields under irrigation.

One of the most common submersed aquatics is *Elodea* (*Anacharis*) spp., sometimees simply called waterweed. Sinc waterweed is such a nondescriptive term, we shall refer to this weed as elodea.

Elodea is a favorite "seaweed" for use in goldfish bowls. Although it is normally rooted, it is easily fragmented and can survive as a floating plant or plant parts. This factor is important when controlling weeds of this sort. Chaining and plowing do not kill it, but merely spread the infestation.

Elodea is normally found in calcareous or hard water, water which contains dissolved calcium minerals. It grows rapidly, frequently branching from nodes. Each node is represented by a

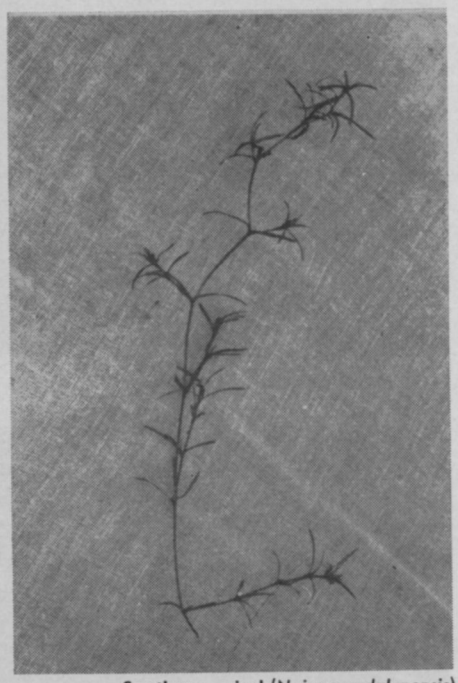
Arrowhead (*Sagittaria* sp.) Staff photo.

Pickerelweed (*Pontederia cordata*)

Arrowarum (*Peltandra* sp.) Staff photo.

Waterprimrose (*Jussiaea grandiflora*) below.

Coontail (*Ceratophyllum demersum*)



Southern naiad (*Najas guadalupensis*)

Watershield (*Brasenia schreberi*). Staff photo.

whorl (circlet) of leaves described as straplike, relatively long and flat. Often the stem grows to such a length that it breaks, and sends out new roots to become established in another place. Vegetative propagation is the prominent means of reproduction, although elodea does reproduce by seed. Sometimes male and female flowers are found on the same plant. Flowers are small and inconspicuous, found growing near stem tips. While developing, the flowers grow on slender filaments to the surface where pollination may take place.

There are two common species of *Elodea*. Most widespread is *Elodea canadensis*, American elodea. This native North American plant became a pest of waterways in Europe soon after it was introduced there.

Elodea densa, Brazilian elodea, is a large species introduced from South America. It is commonly used in aquaria and outdoor pools. It has adjusted to the wild and is now found throughout North America. As the name suggests, leaves grow in a dense whorl around the stem.

Watermilfoils "Smother" Oysters

Another troublesome weed of inland lakes and coastal flats is watermilfoil, family Haloragidaceae, genus *Myriophyllum*. There are about 20 species of this important aquatic weed. Stems of watermilfoil are not greatly branched; leaves occur either in whorls or are alternate on stems. Leaves are finely dissected (featherlike) or branched.

One very important pest species, parrotfeather, *Myriophyllum brasiliense* (*proserpinacoides*), was introduced from South America. It is common along streams, brooks, drainage and irrigation ditches. Reproductive structures and foliage of parrotfeather protrude above the water. It is a pest along the east coast, in Florida and California. Beds of watermilfoil have been known to be so thick that herbicide granules could not penetrate the mat of weeds.

Various watermilfoils have adapted to different water types. No single general statement can be made regarding water and its relationship to milfoil. Some are adapted to hard water and are usually found over a limestone bed. Others are found in noncalcareous waters, and one imported species, eurasian watermilfoil (*M. spicatum*), has adapted to living near the sea in water intermediate in salt content between sea water and fresh water. In these areas, heavy stands of eurasian watermilfoil interfere with oyster farming by killing young oysters and hampering harvesting operations. Thick mats impede water movement, reduce microscopic oyster food, and lower water oxygen content (Steenis and Stotts, 1961). This weed is also a pest in some inland waters.

All watermilfoils are basically alike in that they have very fine, feathery leaves. They are all "rooted" to the bottom by a weak horizontal underwater stem from which new plants sprout.

Coontail, *Ceratophyllum demersum*, is a notorious member of the

Cabomba (*Cabomba caroliniana*)

family Ceratophyllaceae. Coontail is found in every state in the country. It will be found in lakes and ponds where there are sufficient nutrients and organic matter. Wherever it grows, it is usually a plentiful and dominant species.

Recognized by the stem with whorled leaves which bears a resemblance to the tail of a raccoon, coontail has fine forked, pointed leaves. Each leaf in the whorl radiating from the stem has "teeth" or barbs along one edge. This characteristic identifies coontail readily. Coontail appears olive green when viewed through clear water.

Coontail has no roots but is often found with its basal stalk embedded in soft mud early in

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***Note:** As with many chemicals, water treated with DIQUAT should not be used for swimming or drinking purposes until ten days after application. And since it is a herbicide, allow ten days before spraying, irrigating or other uses of treated water.

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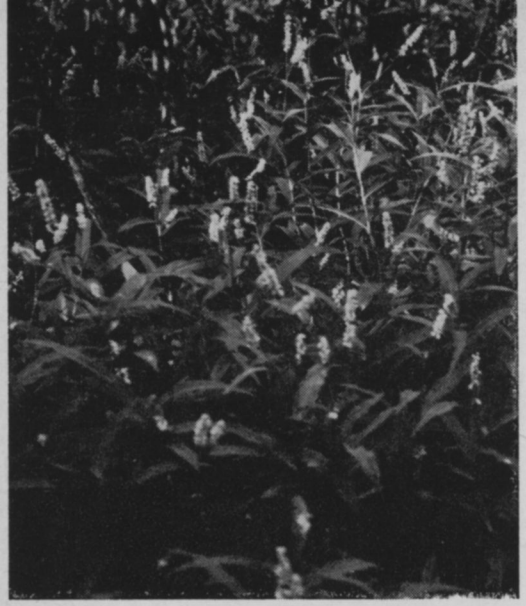
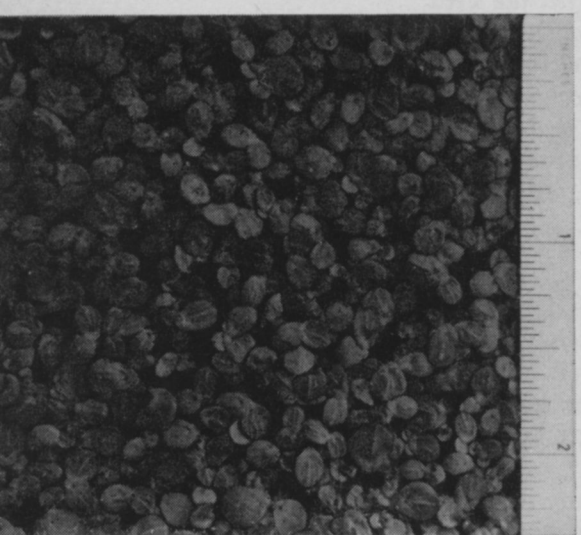


Smartweed (*Polygonum* sp.) Staff photo.



Spirodela (*Spirodela* sp.)

Spatterdock (*Nuphar advena*)

Chara (*Chara* sp.) below.

the growing season. Late in the summer, mats of coontail will float on the surface and drift with wind and water currents. This weed may collect in one portion of a pond or lake and make it entirely unusable for recreational purposes (Hiltibran, 1961).

An aquatic weed which could, at a hasty glance, be taken for coontail is *Cabomba caroliniana* or fanwort. Cabomba is classed by some as a member of the waterlily family, Nymphaceae. It, too, grows entirely submersed. Close observation reveals that leaves are finely divided, but are more fanlike and blunt tipped. They do not have "teeth," as does coontail. Leaves are attached oppositely to the stem rather than in whorls; they are covered with a gelatinous slime, typical of some waterlilies. Cabomba grows entirely under water except from May to September when the plant sends tiny white flowers to the surface along with tiny peltate (shield-shaped) leaves which give a clue as to waterlily kinship.

Sago is Toughest Pondweed

Next on the list of submersed aquatic weeds are the pondweeds, *Potamogeton* spp. Most widely known and toughest to control is sago pondweed (*Potamogeton pectinatus*). Found in nonacid waters (neutral to alkaline, pH 7 or above) in all states, sago pondweed is responsible for blocking flow in thousands of miles of irrigation ditches.

Sago pondweed is a limp, rooted species which bends freely in moving water. Leaves are rounded in cross section, threadlike, taper to a point, and fan out in water. Sago pondweed is a bushy plant and should not be confused with those pondweeds which have long strandlike leaves that float in water.

Widespread over the United States, sago pondweed is one member of the pondweed family which cannot be killed by applications of sodium arsenite (Hiltibran 1961). Therefore, a recognition of this pest is necessary so that adequate control measures can be applied. Other pondweeds with tuberous roots may be difficult to kill with contact herbicides.

The leaves of other Potamogetons vary in form from broad floating leaves to very narrow and submersed leaves and in some species foliage will vary on the same plant. All pondweeds have a flower spike which extends above the water from the mainstem. Their description and identification are very difficult.

Only a few of the more distinctive Potamogetons will be described here. If others are encountered, a textbook key should be used to confirm membership at least to the genus Potamogeton. A county agent or agricultural experiment station can also be helpful when doubtful species need identification.

Curlyleaf is Crispy

Curlyleaf pondweed, *Potamogeton crispus*, as its name indicates, has curled, wavy leaves, a crispy texture, and fine "teeth" along leaf edges. Curlyleaf pondweed is common in temperate United States and extends its range south to Tennessee and Alabama and west to California. It will thrive in hard, muddy, or brackish water.

Another group of submersed pondweeds is the fine-leaved species. These have grasslike leaves which are variable as to the shape of the tip and the type of venation. Leaf edges of fine-leaved pondweeds are entire (smooth) as opposed to the naiad, *Najas* spp., which also has fine leaves, but is finely toothed along both edges.

Naiads: Bushy Pondweeds

Naiads, *Najas* spp., are of the family Najadaceae, although some authors include them in the same family with Potamogetons (Fassett, 1960). Naiads are collectively called bushy pondweeds; they do not exhibit as much variation within the genus as do Potamogetons.

In general, naiads are more uniform plants. Leaves are opposite and somewhat regularly spaced; all leaves are pointed and widen near the base. All species are submersed and there is no leaf variation on individual plants as there is in the Potamogeton pondweeds. Naiads flower from axils of leaves.

Two species which are most widespread and troublesome are southern naiad, *Najas guadalupensis*, and slender naiad, *N. flexilis*.

Southern naiad ranges along the Atlantic and Gulf coasts extending northward through the Mississippi basin onto the Plains and North Central States. It is also common in shallow waters in California. Southern naiad has fine teeth on both edges of leaves. All naiads have a widened base but some taper gradually; some have lobes. Southern naiad tapers gradually to the stem. Its dull seeds are pitted across the middle with

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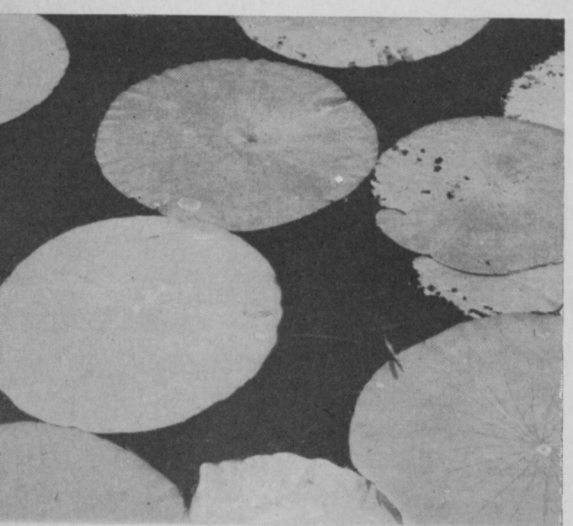

American lotus (*Nelumbo lutea* (*pentapelta*))

Waterlettuce (*Pistia stratioites*) below.

10 to 20 rows of coarse pits. (Hiltibran 1961).

Slender naiad, *Najas flexilis*, also has "toothed" leaves tapering at the base, but seeds are shiny with very fine pits. Slender naiad is a temperate species; it thrives mainly in northern states, ranging westward to the cooler Rocky Mountain and Northwestern States. It is not found in the Plains States.

Any of the several naiad species may be confused with *Elodea* if the naiads appear in closely tufted, shortleaf form. Differentiation is determined by the pointed tips and wider leaf bases of *Najas*, which also has "toothed" leaf edges and flowers in leaf axils.

Final group of submersed weeds to be considered is algae. Algae are free-floating, one-celled, colonial or filamentous, nonflowering plant organisms. A general greenish coloration is imparted to water when algae are present in excess. Sometimes a typical fishy odor will lead one to determine that algae are responsible for the lessened desirability of a lake or pond for recreation.

Increased growth of algae frequently occurs as the result of fertilizer applied to water to increase fish-growing capacity. Generally, the application of fertilizer to ponds already containing higher aquatic weeds is not a good practice. Frequently with the decomposing of higher weeds following herbicide application, algae, because of lessened competition for nutrients, cause water to become sickly green and rather unattractive.

Exact identification of planktonic and filamentous algae is not always necessary because these can generally be controlled with properly applied amounts of copper, such as copper sulfate, also called blue vitriol or bluestone.

One filamentous species which is more difficult to control, and may require more than an inorganic mineral treatment, is *Pithophora* sp. This alga is typical of filamentous types; it grows attached to rocks and other plants. Cells form long, branched, "strings" which resemble hair when wafted by currents. As with some other species already mentioned, *Pithophora* breaks attachments late in the season and masses on the water surface. At this time it is said to look like a mat of wet wool.

Chara spp. is a lower aquatic plant which bears a resemblance to some flowering weeds, but chara does not flower because it is an alga.

Recognized by typical primitive whorled branchlets, and its distinctive musky repulsive odor, chara or stonewort often marks the deepest point of water beyond which no other plants will grow. Beyond the chara line is the water zone which does not receive sufficient light to support rooted plant life (Odum 1959).

Chara is dark green, and very brittle. Since it inhabits calcareous water, it is often encrusted with lime deposits. Heavy stands of chara are said to have a softening effect on the naturally hard water. Presence of chara removes much of the calcium minerals from the water; minerals are apparently "attracted" to chara and held to the plant in an insoluble state. So although water may be suspected to be hard, it should be tested so that controls will be accurate. ("Hard" water is water with large amounts of dissolved calcium and magnesium salts, and high carbonate and bicarbonate alkalinity. Carbonates (CO_3) combine with copper and settle out, reducing the amount of copper for plant control.)

A close look with a hand lens should reveal the stem surface of chara to be ribbed or lined vertically. Chara is highly resistant to most chemicals, and may survive after death of other weeds. Accurate identification can predict this and accusations of job failure will be avoided.

Last group to be considered is surface or floating aquatic weeds. These may or may not be rooted; if rooted, leaves float or extend above the surface; if not rooted, leaves and flowers may stand erect from the floating mat.

One exception will be noted. Some waterlily species will be included in this group although they are rooted and some leaves stand erect, out of the water. Reason for inclusion is so that comparison of different leaf types necessary for identification will be easier.

The duckweed family boasts among its membership the smallest flowering plant and some other very tiny aquatic weeds.

Lemna minor, *Lemna* or common duckweed, is a very small light-green plant which floats on water and reproduces by lateral branching and splitting of the small leaves. Each plant (leaf) has one tiny root which hangs down into the water. Growth and

splitting are very fast and *Lemna* is able to cover a small pond in a short time if left unchecked. Small common duckweed plants are about the diameter of a lead pencil and will be seen near the shore protected from open water by larger plants. If common duckweed covers a pond, wind may cause the tiny plants to be blown to the windward side of the pond where they "climb the banks."

Other members of the duckweed family are *Spirodela* sp., giant duckweed, which has several rootlets hanging from the floating leaf. *Spirodela* is only slightly larger than *Lemna* and is usually red or purple on leaf undersides. *Wolffia* sp., watermeal, is nearly microscopic, has no roots, no leaves, and each plant looks like a green grain of sand or collectively as a green scum floating on the surface. It is the smallest flowering plant known.

Waterhyacinth: Expensive Weed

Waterhyacinth is probably the most undesired aquatic weed in Florida, the Gulf States, and California. Since its introduction as an ornamental and subsequent escape in the late 1800's into the inland waterways of Louisiana and Florida, cost of control has reached millions of dollars.

Waterhyacinth, *Eichhornia crassipes*, is a free-floating flowering plant which spreads mainly by vegetative reproduction, budding new offshoots from a parent plant in rapid order. Growth is in a rosette pattern; leaves are somewhat oval and are supported by a long petiole which is inflated and buoys up the plant. Fibrous roots extend into the water and absorb nutrients. New offshoots are bound to the parent plant by strong stolons. Flowers are very showy and attractive, colored white, blue, or violet; there are 6 petals fused into a tube at the base. Many flowers are borne on a single spike.

Waterhyacinth propagates so rapidly that mechanical control is often too slow to keep up with reinfestation. Excessively heavy growths clog canals so that navigation is precluded.

Waterlettuce, *Pistia stratioites*, is similar to waterhyacinth in that it is a floating plant, but it does not clog waterways as much because interplant underwater connections are weak and easily broken. Waterlettuce has a range similar to waterhyacinth except that it does not occur in California, but does occur in Arizona.

Fleshy, prominently veined leaves have a covering of short, fine hair which makes liquid chemical control difficult without a wetting agent (Weldon 1962).

Waterlettuce may sometimes be found stranded on mud flats at which time it will take root weakly in mud. This plant has a flower, but it is a very inconspicuous one and not necessary for identification.

Waterlilies, family Nymphaceae, are easily recognized by the large, floating leaves, or pads, and showy white or yellow flowers. There are 4 genera of importance in this family.

Leaf Structure Spots Waterlilies

Watershield, *Brasenia schreberi*, is the only species in this genus and is identified by the eliptical (peltate) floating leaf with the petiole, or leaf stalk, attached to the middle of the leaf underside. Watershield leaves have no split as do some other waterlilies. To confirm identification, leaf undersides and petiole are typically covered with a jellylike mucilage.

Watershield flowers are less conspicuous than larger waterlilies and not needed for identification purposes. Watershield is amply distributed throughout eastern United States and occurs locally in the Pacific Northwest.

American lotus, *Nelumbo lutea* (*pentapelta*), is also the only native species in this genus and is easily identified by the circular floating leaf which is connected to slender, horizontal roots by a stout petiole which joins the circular leaf in the middle. Leaves are somewhat depressed or saucer shaped, and very waxy to the touch. There is no split in leaves.

In the center of the lotus flower, made up of numerous pale-yellow petals, is the conical, fleshy receptacle in which seeds are formed. No other member of the waterlily family has such a conical receptacle; all others are globular.

Of the remaining two genera, spatterdock, *Nuphar advena*, and white waterlily, *Nymphaea* spp., identification may be determined by venation of the floating or erect leaves.

Both genera have variable leaves; that is, they vary from nearly circular to somewhat arrowhead shaped. Leaves of both genera have a split at the point where the petiole joins the leaf. Despite these similarities, overall venation of the leaves is different.

Nuphar or spatterdock has a

(*Continued on page W-36*)

Guide to Suppliers of Weed & Turf Chemicals

Weeds and Turf presents below its annual Guide to Suppliers of vegetation control chemicals for use by contract applicators in urban/industrial areas. There is a mixture of common and trade-marked names (indicated by an asterisk*). This has been unavoidable since usage and recommendations of researchers refer to a particular chemical by one or the other, depending upon the newness of the compound, whether its common name is easier to use, or industry acceptance. There will also be some differences of opinion over the inclusion or omission of certain chemicals under particular use categories. Here again confusion exists among reference sources. We have made our choices on the basis of most frequent mention in our surveys which preceded this compilation. Readers' comments and suggestions are invited to help us improve future editions. Keep this year's Guide handy for frequent use.

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Southern Mill Creek Products Co.

DALAPON

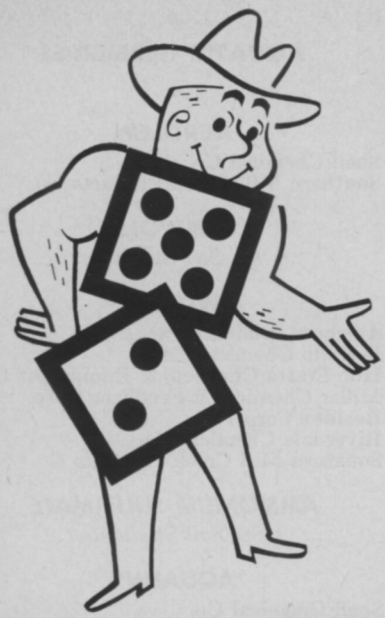
See Soil Sterilants

DIURON

See Soil Sterilants

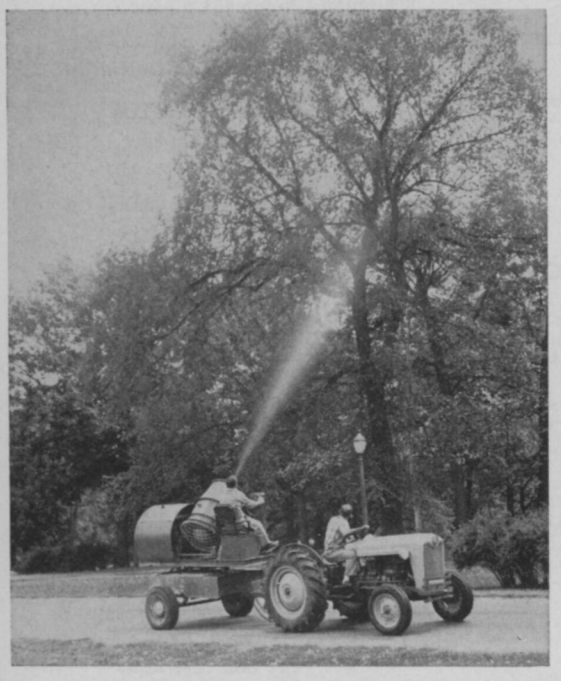
DMA

Ansul Chemical Co.
Chapman Chemical Co.
Chipman Chemical Co., Inc.
W. A. Cleary Corp.
E-Z Flo Chemical Co.
Lobel Chemical Corp.



Control Insects
this better, safer way!
USE SEVIN®
INSECTICIDE

Effective and long-lasting SEVIN provides powerful control of major insect pests of trees and shrubs. SEVIN is safer to handle and safer to birds and wildlife than most other insecticides.



You knock out chinch bug, sod webworm and many other turf pests easily with SEVIN. It is deadly to insects, and its lower toxicity to humans, pets, birds and fish makes SEVIN ideal to use in any turf area.

SEVIN controls Japanese beetle, rose slug, codling moth, leafhopper and other insects on garden trees, flowers and vegetables—with few applications. Versatile SEVIN controls more than 150 different insects.

Gypsy moth, cankerworm, forest tent caterpillar and other major pests of forest and woodland trees are readily controlled with SEVIN insecticide. Drift is no problem, even to nearby pastures, fields or streams.

SEVIN insecticide gives you a wide margin of safety in insect control programs that provide effective, long-lasting, economical results. Powerful against insects, but safer to handle and use than most other insecticides, SEVIN is ideal for use by your spray crews in urban and suburban areas as well as in country recreation developments. For detailed information, contact: Union Carbide Chemicals, 270 Park Ave., New York, N. Y. 10017.

UNION CARBIDE **AGRICULTURAL CHEMICALS**

SEVIN is the registered trade mark of Union Carbide Corporation for carbaryl insecticide.

Miller Chemical & Fertilizer Corp.
Riverdale Chemical Co.
Southern Mill Creek Products Co.
Stauffer Chemical Co.
Stephenson Chemical Co., Inc.
Vineland Chemical Sales Corp.

ENDOTHALL

Chipman Chemical Co., Inc.
E-Z Flo Chemical Co.
Pennsalt Chemicals Corp.
Southern Mill Creek Products Co.

*FENAC**

See Soil Sterilants

FENURON

Chapman Chemical Co.
E. I. duPont de Nemours & Co.
E-Z Flo Chemical Co.
Nalco Chemical Co.
Southern Mill Creek Products Co.

HCA

See Soil Sterilants

*HYVAR**

Chapman Chemical Co.
Chipman Chemical Co., Inc.
E. I. duPont de Nemours & Co.
Nalco Chemical Co.
Southern Mill Creek Products Co.

MCPA

Chipman Chemical Co., Inc.
Diamond Alkali Co.
Dow Chemical Co.
E-Z Flo Chemical Co.
Lobel Chemical Co.
Nalco Chemical Co.
Riverdale Chemical Co.

MONURON

See Soil Sterilants

NEBURON

E-Z Flo Chemical Co.
Residex Corp.

PHENYLMERCURIC ACETATE

W. A. Cleary Corp.
Lobel Chemical Corp.
Mallinckrodt Chemical Works
Vineland Chemical Sales Corp.

*PROMETONE**

See Soil Sterilants

*PROPAZINE**

Chapman Chemical Co.
E-Z Flo Chemical Co.
Geigy Agricultural Chemicals
Neil A. Maclean Co., Inc.
Nalco Chemical Co.
Residex Corp.
Riverdale Chemical Co.
Southern Mill Creek Products Co.

SILVEX

Amchem Products, Inc.
Black Leaf Products Co.
Chapman Chemical Co.
Chipman Chemical Co., Inc.
Diamond Alkali Co.
Dow Chemical Co.
E-Z Flo Chemical Co.
Hercules Powder Co.
Neil A. Maclean Co., Inc.
Miller Chemical & Fertilizer Corp.
Miller Products Co.
Nalco Chemical Co.
Pennsalt Chemicals Corp.
Residex Corp.
Riverdale Chemical Co.
Smith Douglass Co., Inc.
Southern Mill Creek Products Co.
Thompson Chemicals Corp.
Thompson-Hayward Chemical Co.
Woodbury Chemical Co.

*TORDON**

Dow Chemical Co.

*TRITAC-D**

Hooker Chemical Corp.

*TRYSBEN**

California Chemical Co., Ortho Div.
Campbell Manufacturing Co.
Chapman Chemical Co.
E. I. duPont de Nemours & Co.
E-Z Flo Chemical Co.
Nalco Chemical Co.
Southern Mill Creek Products Co.

2,4-D

Amchem Products, Inc.
Black Leaf Products Co.
California Chemical Co., Ortho Div.
Campbell Manufacturing Co.
Chapman Chemical Co.
Chemagro Corp.
Chipman Chemical Co., Inc.
W. A. Cleary Corp.
Diamond Alkali Co.
Dow Chemical Co.
E-Z Flo Chemical Co.
General Chemical Div., ACC
Hercules Powder Co.
Heritage House Products, Inc.
Hub States Chemical & Equipment Co.
Lobel Chemical Corp.
Neil A. Maclean Co., Inc.
Miller Chemical & Fertilizer Corp.
Miller Products Co.
Nalco Chemical Co.
Niagara Chemical Div., FMC
B. G. Pratt Co.
Residex Corp.
Riverdale Chemical Co.
Smith Douglass Co., Inc.
Southern Mill Creek Products Co.
Stauffer Chemical Co.
Stephenson Chemical Co., Inc.
Thompson Chemicals Corp.
Thompson-Hayward Chemical Co.
Woodbury Chemical Co.
York Chemical Co., Inc.

2,4,5-T

Amchem Products, Inc.
Black Leaf Products Co.
California Chemical Co., Ortho Div.
Campbell Manufacturing Co.
Chapman Chemical Co.
Chipman Chemical Co., Inc.
W. A. Cleary Corp.
Diamond Alkali Co.
Dow Chemical Co.
E-Z Flo Chemical Co.
General Chemical Div., ACC
Hercules Powder Co.
Hub States Chemical & Equipment Co.
Lobel Chemical Corp.
Neil A. Maclean Co., Inc.
Miller Chemical & Fertilizer Corp.
Miller Products Co.
Nalco Chemical Co.
National Chemsearch Corp.
Niagara Chemical Div., FMC
B. G. Pratt Co.
Residex Corp.
Riverdale Chemical Co.
Smith Douglass Co., Inc.
Southern Mill Creek Products Co.
Stauffer Chemical Co.
Stephenson Chemical Co., Inc.
Thompson Chemicals Corp.
Thompson-Hayward Chemical Co.
Woodbury Chemical Co.
York Chemical Co., Inc.

*ZOBAR**

E-Z Flo Chemical Co.

AQUATIC HERBICIDES

ACROLEIN

Shell Chemical Co.
Southern Mill Creek Products Co.

AMITROLE

See Soil Sterilants

*AMITROL-T**

Amchem Products, Inc.
E-Z Flo Chemical Co.
Hub States Chemical & Equipment Co.
Miller Chemical & Fertilizer Corp.
Residex Corp.
Riverdale Chemical Co.
Southern Mill Creek Products Co.

AMMONIUM SULFAMATE

See Soil Sterilants

*AQUALIN**

Shell Chemical Co.
Southern Mill Creek Products Co.

*AQUATHOL**

E-Z Flo Chemical Co.
Chipman Chemical Co., Inc.
Pennsalt Chemicals Corp.
Southern Mill Creek Products Co.
Thompson-Hayward Chemical Co.

*AQUATHOL PLUS**

Chipman Chemical Co., Inc.
E-Z Flo Chemical Co.
Pennsalt Chemicals Corp.
Thompson-Hayward Chemical Co.

CIPC

See Pre-Emergent Herbicides

*DACAMINE**

See Post-Emergent Herbicides

DALAPON

See Soil Sterilants

*DIQUAT**

California Chemical Co., Ortho Div.
Chipman Chemical Co., Inc.
Residex Corp.

DIURON

See Soil Sterilants

ERBON

See Soil Sterilants

*FENAC**

See Soil Sterilants

HCA

See Soil Sterilants

*HYDROTHOL**

Pennsalt Chemicals Corp.

*KUROSAL**

Dow Chemical Co.
Residex Corp.

MCPA

See Post-Emergent Herbicides

ORTHODICHLOROBENZENE

Miller Chemical & Fertilizer Corp.
Pittsburgh Plate Glass, Chem. Div.
Residex Corp.
Robeco Chemicals, Inc.
Southern Mill Creek Products Co.

You can now kill brush on a year 'round basis

The key: Dormant Cane Broadcast — Scientists' concepts of chemical brush killing used to be that woody plants could not be effectively controlled with winter-month application. Diamond, however, sponsored research on this unique application method of brush control with the use of six-pound acid equivalent Line Rider formulations. The results speak for themselves:

• Materials needed reduced • Application time in hours per acre reduced • Kill effectiveness increased • Effective spray season lengthened • Hazard of crop damage eliminated • Unsightly brown-out eliminated.

Diamond's experience and specific formulation techniques with dormant cane broadcast can be of help to you. For details on dormant cane broadcast or six-pound Line Rider products, write Diamond Alkali Company, 300 Union Commerce Building, Cleveland, Ohio 44114.

Diamond Chemicals

PBA
See Soil Sterilants

SILVEX
See Post-Emergent Herbicides

SODIUM ARSENITE
See Soil Sterilants

2,4-D
See Post-Emergent Herbicides

2,4,5-T
See Post-Emergent Herbicides

TCA
See Soil Sterilants

ALGICIDES

BORASCU*
Stephenson Chemical Co., Inc.
U. S. Borax & Chemical Corp.

CALCIUM HYPOCHLORITE
Pennsalt Chemicals Corp.
Pittsburgh Plate Glass, Chem. Div.
Robeco Chemicals, Inc.
Smith Douglass Co., Inc.

CETYL PICOLINIUM BROMIDE
Michigan Chemical Corp.

COPPER METHYL ARSONATE
Ansul Chemical Co.
E-Z Flo Chemical Co.

COPPER SULFATE
E-Z Flo Chemical Co.
Hopkins Agricultural Chemical Co.
Hub States Chemical & Equipment Co.
Lobel Chemical Corp.
Miller Chemical & Fertilizer Corp.
Niagara Chemical Div., FMC
Phelps Dodge Refining Co.
Robeco Chemicals, Inc.
Smith Douglass Co., Inc.
Southern Mill Creek Products Co.
Stauffer Chemical Co.
Stephenson Chemical Co.
Tennessee Corp.

DELRAD*
Hercules Powder Co.
Southern Mill Creek Products Co.

DICHLONE
E-Z Flo Chemical Co.
General Chemical Div., ACC
M. W. Hardy & Co., Inc.
Miller Chemical & Fertilizer Corp.
Naugatuck Chemical

DIURON
See Soil Sterilants

DIQUAT*
See Aquatic Herbicides

FERMATE*
E-Z Flo Chemical Co.
Lobel Chemical Corp.
Niagara Chemical Div., FMC
Smith Douglass Co., Inc.
Southern Mill Creek Products Co.
Stauffer Chemical Co.
Stephenson Chemical Co., Inc.

HYAMINE*
Rohm & Haas Co.

POTASSIUM IODIDE
Mallinckrodt Chemical Works

PHYGON XL*
E-Z Flo Chemical Co.
General Chemical Div., ACC
Lobel Chemical Corp.
Niagara Chemical Div., FMC
Southern Mill Creek Products Co.

SODIUM ARSENITE
See Soil Sterilants

CHELATING AGENTS

IRON CHELATE
Chapman Chemical Co.
Geigy Agricultural Chemicals
Hub States Chemical & Equipment Co.
Lobel Chemical Corp.
Neil A. Maclean Co., Inc.
National Chemsearch Corp.
Residex Corp.
Riverdale Chemical Co.
Southern Mill Creek Products Co.
Stephenson Chemical Co., Inc.
York Chemical Co., Inc.

SEQUESTRENE PRODUCTS
Chapman Chemical Co.
E-Z Flo Chemical Co.
Geigy Agricultural Chemicals
Hub States Chemical & Equipment Co.
Neil A. Maclean Co., Inc.
Pest Control Equipment Co.
Prentiss Drug & Chemical Co., Inc.
Riverdale Chemical Co.
Southern Mill Creek Products Co.
York Chemical Co., Inc.

VERSENOL
Dow Chemical Co.

FUNGICIDES

ACTI-DIONE*
E-Z Flo Chemical Co.
Pest Control Equipment Co.
Southern Mill Creek Products Co.
Upjohn Co.

CADMINATE*
Mallinckrodt Chemical Works

CADMIUM COMPOUNDS
W. A. Cleary Corp.
Mallinckrodt Chemical Works
Metalsalts Corp.
National Chemsearch Corp.
Southern Mill Creek Products Co.
Stephenson Chemical Co., Inc.
Vineland Chemical Sales Corp.

CALO-CLOR*
Mallinckrodt Chemical Works

CALOCURE*
Mallinckrodt Chemical Works

CALOMEL
Doggett Fison Co.
General Chemical Div., ACC
Mallinckrodt Chemical Works

CAPTAN*
California Chemical Co., Ortho Div.
Chapman Chemical Co.
E-Z Flo Chemical Co.
Hub States Chemical & Equipment Co.
Lobel Chemical Corp.
Neil A. Maclean Co., Inc.
Miller Products Co.
Smith Douglass Co., Inc.
Southern Mill Creek Products Co.
Stauffer Chemical Co.
Stephenson Chemical Co., Inc.

CERESAN*
E. I. duPont de Nemours & Co.
E-Z Flo Chemical Co.
Southern Mill Creek Products Co.

COPPER SULFATE
See Algicides

CORROSIVE SUBLIMATE
Doggett Fison Co.
General Chemical Div., ACC
Mallinckrodt Chemical Works

DICHLONE
See Algicides

DICHLOROPROPENE FUMIGANTS
Smith Douglass Co., Inc.
Stephenson Chemical Co., Inc.

DITHANE M-45*
Rohm & Haas Co.

DYRENE*
Chemagro Corp.
E-Z Flo Chemical Co.
Heritage House Products, Inc.
Neil A. Maclean Co., Inc.
Stephenson Chemical Co., Inc.

EMMI*
Riverdale Chemical Co.
Southern Mill Creek Products Co.
Stephenson Chemical Co., Inc.
Velsicol Chemical Corp.

FERBAM
Chipman Chemical Co., Inc.
E. I. duPont de Nemours & Co.

FOLPET
California Chemical Co., Ortho Div.
E-Z Flo Chemical Co.
Riverdale Chemical Co.
Stauffer Chemical Co.

GLYODIN
E-Z Flo Chemical Co.
Miller Chemical & Fertilizer Corp.
Niagara Chemical Div., FMC
Pittsburgh Plate Glass, Chem. Div.
Union Carbide Corp., Chemicals Div.

KARATHANE
See Miticides

KROMAD*
Mallinckrodt Chemical Works
Southern Mill Creek Products Co.

MANEB
E. I. duPont de Nemours & Co.
Rohm & Haas Co.

MERCURAM*
Vineland Chemical Sales Corp.

METHYL BROMIDE
California Chemical Co., Ortho Div.
Chapman Chemical Co.
Dow Chemical Co.
E-Z Flo Chemical Co.
Frontier Chemical Co.
Great Lakes Chemical Corp.
Hub States Chemical & Equipment Co.
Lobel Chemical Corp.
Neil A. Maclean Co., Inc.
Michigan Chemical Corp.
Miller Chemical & Fertilizer Co.
Niagara Chemical Div., FMC
Pest Control Equipment Co.
Residex Corp.

Smith Douglass Co., Inc.
Southern Mill Creek Products Co.
Stephenson Chemical Co., Inc.
Thompson-Hayward Chemical Co.

NABAM

California Chemical Co., Ortho Div.
E. I. duPont de Nemours & Co.
E-Z Flo Chemical Co.
Neil A. Maclean Co., Inc.
Niagara Chemical Div., FMC
Rohm & Haas Co.
Southern Mill Creek Products Co.
Stauffer Chemical Co.
Woodbury Chemical Co.

NEMAGON*

California Chemical Co., Ortho Div.
Chapman Chemical Co.
E-Z Flo Chemical Co.
Miller Chemical & Fertilizer Corp.
B. G. Pratt Co.
Prentiss Drug & Chemical Co., Inc.
Shell Chemical Co.
Smith Douglas Co., Inc.
Southern Mill Creek Products Co.
Stauffer Chemical Co.
Stephenson Chemical Co., Inc.

PANOGEN*

E-Z Flo Chemical Co.
Neil A. Maclean Co., Inc.
Morton Chemical Co.
Riverdale Chemical Co.
Stephenson Chemical Co., Inc.

PHENYLMERCURY

Chipman Chemical Co., Inc.
W. A. Cleary Corp.
Doggett Fison Co.
Mallinckrodt Chemical Works
Metalsalts Corp.
Niagara Chemical Div., FMC
Southern Mill Creek Products Co.
Vineland Chemical Sales Corp.

SEMESAN*

E. I. duPont de Nemours & Co.
E-Z Flo Chemical Co.

SULFUR

Smith Douglass Co., Inc.
Stauffer Chemical Co.

TERSAN*

E. I. duPont de Nemours & Co.
E-Z Flo Chemical Co.
Southern Mill Creek Products Co.

THIRAM

W. A. Cleary Corp.
Doggett Fison Co.
E. I. duPont de Nemours & Co.
E-Z Flo Chemical Co.
Lobel Chemical Corp.
Mallinckrodt Chemical Works
Metalsalts Corp.
Niagara Chemical Div., FMC
Pennsalt Chemicals Corp.
Robeco Chemicals, Inc.
Southern Mill Creek Products Co.
Stephenson Chemical Co., Inc.

THIURAM*

Vineland Chemical Sales Corp.

ZINEB

Black Leaf Products Co.
California Chemical Co., Ortho Div.
Chapman Chemical Co.
Chipman Chemical Co., Inc.
E. I. duPont de Nemours & Co.
E-Z Flo Chemical Co.
Hub States Chemical & Equipment Co.
Lobel Chemical Corp.
Neil A. Maclean Co., Inc.
Niagara Chemical Div., FMC
Pennsalt Chemicals Corp.
Prentiss Drug & Chemical Co., Inc.
Rohm & Haas Co.
Smith Douglass Co., Inc.
Southern Mill Creek Products Co.
Stauffer Chemical Co.
Stephenson Chemical Co., Inc.
Thompson-Hayward Chemical Co.
Woodbury Chemical Co.

GRANULAR CARRIERS

ATTACLAY

Chapman Chemical Co.
E-Z Flo Chemical Co.
Minerals & Chemicals Philipp Corp.
Stephenson Chemical Co., Inc.
Thompson-Hayward Chemical Co.

PERLITE*

Great Lakes Carbon Corp.

VERMICULITE

Zonolite Div., W. R. Grace & Co.

GROWTH RETARDANTS

PHOSFON*

Lobel Chemical Corp.
Virginia-Carolina Chemical Corp.

MALEIC HYDRAZIDE

California Chemical Co., Ortho Div.
E-Z Flo Chemical Co.
Naugatuck Chemical
Southern Mill Creek Products Co.

INSECTICIDES

ALDRIN

California Chemical Co., Ortho Div.
Campbell Manufacturing Co.
Chapman Chemical Co.
Chipman Chemical Co., Inc.
General Chemical Div., ACC
Hub States Chemical & Equipment Co.
Lobel Chemical Corp.
Neil A. Maclean Co., Inc.
Miller Products Co.
Niagara Chemical Div., FMC
Pennsalt Chemicals Corp.
Pest Control Equipment Co.
Prentiss Drug & Chemical Co., Inc.
Riverdale Chemical Co.
Shell Chemical Co.
Smith Douglass Co., Inc.
Southern Mill Creek Products Co.
Stauffer Chemical Co.
Stephenson Chemical Co., Inc.
Thompson-Hayward Chemical Co.
Woodbury Chemical Co.

*ASPON**

Southern Mill Creek Products Co.
Stauffer Chemical Co.

BHC

California Chemical Co., Ortho Div.
Chapman Chemical Co.
Chipman Chemical Co., Inc.
Diamond Alkali Co.
E-Z Flo Chemical Co.
General Chemical Div., ACC
Hooker Chemical Corp.
Hub States Chemical & Equipment Co.
Lobel Chemical Corp.
Neil A. Maclean Co., Inc.
Miller Products Co.
Niagara Chemical Div., FMC
Pennsalt Chemicals Corp.
Pittsburgh Plate Glass, Chem. Div.
Riverdale Chemical Co.
Southern Mill Creek Products Co.
Stauffer Chemical Co.
Stephenson Chemical Co., Inc.
Woodbury Chemical Co.

CHLORDANE

Black Leaf Products Co.
California Chemical Co., Ortho Div.
Chapman Chemical Co.
Chipman Chemical Co., Inc.
W. A. Cleary Corp.
Doggett Fison Co.
E-Z Flo Chemical Co.
Heritage House Products, Inc.
Hub States Chemical & Equipment Co.
Lobel Chemical Corp.
Neil A. Maclean Co., Inc.
Miller Chemical & Fertilizer Corp.
Miller Products Co.
National Chemsearch Corp.
Naugatuck Chemical
Niagara Chemical Div., FMC
S. B. Penick & Co.
Pennsalt Chemicals Corp.
Pest Control Equipment Co.
B. G. Pratt Co.
Prentiss Drug & Chemical Co., Inc.
Residex Corp.
Riverdale Chemical Co.
Smith Douglass Co., Inc.
Southern Mill Creek Products Co.
Stauffer Chemical Co.
Stephenson Chemical Co., Inc.
Thompson Chemicals Corp.
Thompson-Hayward Chemical Co.
Utility Chemical Co.
Velsicol Chemical Corp.
Woodbury Chemical Co.
York Chemical Co., Inc.

DDT

Black Leaf Products Co.
California Chemical Co., Ortho Div.
Campbell Manufacturing Co.
Chapman Chemical Co.
Chipman Chemical Co., Inc.
Diamond Alkali Co.
Doggett Fison Co.
E-Z Flo Chemical Co.
General Chemical Div., ACC
Hub States Chemical & Equipment Co.
Lobel Chemical Corp.
Neil A. Maclean Co., Inc.
Miller Chemical & Fertilizer Corp.
Miller Products Co.
Niagara Chemical Div., FMC
S. B. Penick & Co.
Pennsalt Chemicals Corp.
Pest Control Equipment Co.
B. G. Pratt Co.
Prentiss Drug & Chemical Co., Inc.
Residex Corp.
Riverdale Chemical Co.
Smith Douglass Co., Inc.
Southern Mill Creek Products Co.
Stauffer Chemical Co.
Stephenson Chemical Co., Inc.
Thompson Chemicals Corp.
Thompson-Hayward Chemical Co.
Woodbury Chemical Co.

DDVP

Chapman Chemical Co.
Norda Essential Oil & Chemical Co.
Shell Chemical Co.

DELNAV

California Chemical Co., Ortho Div.
Chapman Chemical Co.

Hercules Powder Co.
Neil A. Maclean Co., Inc.
Southern Mill Creek Products Co.
York Chemical Co., Inc.

DIAZINON

California Chemical Co., Ortho Div.
Campbell Manufacturing Co.
Chapman Chemical Co.
Doggett Fison Co.
E-Z Flo Chemical Co.
Geigy Agricultural Chemicals
Hub States Chemical & Equipment Co.
Lobel Chemical Corp.
Neil A. Maclean Co., Inc.
Miller Chemical & Fertilizer Corp.
Miller Products Co.
Niagara Chemical Div., FMC
Pest Control Equipment Co.
B. G. Pratt Co.
Prentiss Drug & Chemical Co., Inc.
Residex Corp.
Riverdale Chemical Co.
Southern Mill Creek Products Co.
Stauffer Chemical Co.
Stephenson Chemical Co., Inc.
Thompson-Hayward Chemical Co.
York Chemical Co., Inc.

*DIBROM**

California Chemical Co., Ortho Div.
Chipman Chemical Co., Inc.
E-Z Flo Chemical Co.
Hub States Chemical & Equipment Co.
Niagara Chemical Div., FMC
Stauffer Chemical Co.

DIELDRIN

Black Leaf Products Co.
California Chemical Co., Ortho Div.
Campbell Manufacturing Co.
Chapman Chemical Co.
Chipman Chemical Co., Inc.
E-Z Flo Chemical Co.
General Chemical Div., ACC
Hub States Chemical & Equipment Co.
Lobel Chemical Corp.
Neil A. Maclean Co., Inc.
Miller Products Co.
National Chemsearch Corp.
Niagara Chemical Div., FMC
Pennsalt Chemicals Corp.
Pest Control Equipment Co.
B. G. Pratt Co.
Prentiss Drug & Chemical Co., Inc.
Riverdale Chemical Co.
Shell Chemical Co.
Smith Douglass Co., Inc.
Southern Mill Creek Products Co.
Stauffer Chemical Co.
Stephenson Chemical Co., Inc.
Thompson Chemicals Corp.
Thompson-Hayward Chemical Co.
Woodbury Chemical Co.
York Chemical Co., Inc.

DINITRO COMPOUNDS

California Chemical Co., Ortho Div.
Dow Chemical Co.
E-Z Flo Chemical Co.
Neil A. Maclean Co., Inc.
Niagara Chemical Div., FMC
Smith Douglass Co., Inc.
Stauffer Chemical Co.

*DISYSTON**

California Chemical Co., Ortho Div.
Chapman Chemical Co.
Chemagro Corp.
Chipman Chemical Co., Inc.
E-Z Flo Chemical Co.

DORMANT OILS

California Chemical Co., Ortho Div.
E-Z Flo Chemical Co.
Hub States Chemical & Equipment Co.
Miller Products Co.
Niagara Chemical Div., FMC
Pennsalt Chemicals Corp.
B. G. Pratt Co.
Southern Mill Creek Products Co.

*DRINOX**

Morton Chemical Co.

ENDRIN

Prentiss Drug & Chemical Co.
Shell Chemical Co.
Smith Douglass Co., Inc.
Velsicol Chemical Corp.

*ETHION**

California Chemical Co., Ortho Div.
Chapman Chemical Co.
E-Z Flo Chemical Co.
General Chemical Div., ACC
Hub States Chemical & Equipment Co.
Miller Chemical & Fertilizer Corp.
Niagara Chemical Div., FMC
Southern Mill Creek Products Co.
Stephenson Chemical Co., Inc.

*GUTHION**

Chemagro Corp.

HEPTACHLOR

California Chemical Co., Ortho Div.
Campbell Manufacturing Co.
Chapman Chemical Co.
Chipman Chemical Co., Inc.
E-Z Flo Chemical Co.
General Chemical Div., ACC
Hub States Chemical & Equipment Co.
Lobel Chemical Corp.
Miller Products Co.
Niagara Chemical Div., FMC
Pennsalt Chemicals Corp.
Pest Control Equipment Co.

B. G. Pratt Co.
Prentiss Drug & Chemical Co., Inc.
Riverdale Chemical Co.
Smith Douglass Co., Inc.
Southern Mill Creek Products Co.
Stauffer Chemical Co.
Stephenson Chemical Co., Inc.
Thompson-Hayward Chemical Co.
Velsicol Chemical Corp.
Woodbury Chemical Co.

*KORLAN**

Dow Chemical Co.

LEAD ARSENATE

California Chemical Co., Ortho Div.
Chipman Chemical Co., Inc.
E-Z Flo Chemical Co.
General Chemical Div., ACC
Hub States Chemical & Equipment Co.
Lobel Chemical Corp.
Neil A. Maclean Co., Inc.
Niagara Chemical Div., FMC
Smith Douglass Co., Inc.
Southern Mill Creek Products Co.
Stauffer Chemical Co.
Thompson-Hayward Chemical Co.
Woodbury Chemical Co.

LETHANE

Rohm & Haas Co.

LIME SULFUR

California Chemical Co., Ortho Div.
E-Z Flo Chemical Co.
General Chemical Div., ACC
Miller Products Co.
Niagara Chemical Div., FMC
Thompson-Hayward Chemical Co.

LINDANE

California Chemical Co., Ortho Div.
Chapman Chemical Co.
Chipman Chemical Co., Inc.
Diamond Alkali Co.
Doggett Fison Co.
E-Z Flo Chemical Co.
General Chemical Div., ACC
Hooker Chemical Corp.
Hub States Chemical & Equipment Co.
Lobel Chemical Corp.
Neil A. Maclean Co., Inc.
Miller Chemical & Fertilizer Corp.
Miller Products Co.
Niagara Chemical Div., FMC
S. B. Penick & Co.
Pennsalt Chemicals Corp.
Pest Control Equipment Co.
B. G. Pratt Co.
Prentiss Drug & Chemical Co., Inc.
Residex Corp.
Riverdale Chemical Co.
Robeco Chemicals, Inc.
Smith Douglass Co., Inc.
Southern Mill Creek Products Co.
Stauffer Chemical Co.
Stephenson Chemical Co., Inc.
Thompson-Hayward Chemical Co.
Woodbury Chemical Co.
York Chemical Co., Inc.

MALATHION

American Cyanamid Co.
Black Leaf Products Co.
California Chemical Co., Ortho Div.
Campbell Manufacturing Co.
Chapman Chemical Co.
Chipman Chemical Co., Inc.
Doggett Fison Co.
E-Z Flo Chemical Co.
General Chemical Div., ACC
Hub States Chemical & Equipment Co.
Lobel Chemical Corp.
Neil A. Maclean Co., Inc.
Miller Chemical & Fertilizer Corp.
Miller Products Co.
National Chemsearch Corp.
Niagara Chemical Div., FMC
Pennsalt Chemicals Corp.
Pest Control Equipment Co.
B. G. Pratt Co.
Prentiss Drug & Chemical Co., Inc.
Residex Corp.
Riverdale Chemical Co.
Smith Douglass Co., Inc.
Southern Mill Creek Products Co.
Stauffer Chemical Co.
Stephenson Chemical Co., Inc.
Thompson Chemicals Corp.
Thompson-Hayward Chemical Co.
Woodbury Chemical Co.
York Chemical Co., Inc.

*METACIDE**

Chemagro Corp.

METALDEHYDE

Commercial Solvents Corp.

METHOXYCHLOR

California Chemical Co., Ortho Div.
Chapman Chemical Co.
E. I. duPont de Nemours & Co., Inc.
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Miller Chemical & Fertilizer Corp.
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Alphabetical Listing of Suppliers in this Buyer's Guide with their Complete Addresses

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Ansul Chemical Co., Marinette, Wis.

B
Black Leaf Products Co. 6147 N. Broadway, Chicago 26, Ill.

C
California Chemical Co., Ortho Div. 200 Bush St., San Francisco, Calif.
Campbell Manufacturing Co. Walthill, Nebr.
Chapman Chemical Co., Box 3158 Mallory Station, Memphis, Tenn.
Chemagro Corp., P.O. Box 4913, Kansas City 20, Mo.
Chipman Chemical Co., Inc., Bound Brook, N.J.
W. A. Cleary Corp., Box 749 New Brunswick, N.J.
Commercial Solvents Corp., 260 Madison Ave., New York 16, N.Y.

D
Diamond Alkali Co., Union Commerce Bldg., Cleveland, O.
Doggett Fison Co., 191 Mountain Ave., Springfield, N.J.
The Dow Chemical Co., Midland, Mich.
E. I. duPont de Nemours & Co., Inc., Ag. Chem. Dept., Wilmington 98, Del.

E
E-Z Flo Chemical Co., P.O. Box 808, Lansing 3, Mich.

F
Frontier Chemical Co., 600 Doremus Ave., Newark 5, N.J.

G
Geigy Agricultural Chemicals, Saw Mill River Road, Ardsley, N.Y.
General Chemical Div., ACC, P.O. Box 70, Morristown, N.J. 07960
Great Lakes Carbon Corp., 612 S. Flower St., Los Angeles, Calif.
Great Lakes Chemical Corp., P.O. Box 472, W. Lafayette, Ind.

H
Harder Arborist Supply Co., P. O. Box 111, Hempstead, N. Y.
M. W. Hardy & Co., Inc., 141 Broadway, New York 6, N.Y.
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Hooker Chemical Corp., 65 Iroquois St., Niagara Falls, N.Y.
Hopkins Agricultural Chemical Co., P.O. Box 584, Madison 1, Wis.
Hub States Chemical & Equipment Co., 1255 N. Windsor St., Indianapolis 1, Ind.

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Industrial Materials Co., Buck & McCall Sts., Houston 20, Tex.

L

Lobel Chemical Corp., 165 Broadway, New York 6, N.Y.

M

Neil A. Maclean Co., Inc., 1536 Industrial Way, Belmont, Calif.
Mallinckrodt Chemical Works, Second & Mallinckrodt Sts., St. Louis 47, Mo.
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Metalsalts Corp., 200 Wagaraw Rd., Hawthorne, N.J.
Michigan Chemical Corp., 500 N. Bankson St., St. Louis, Mo.
Miller Chemical & Fertilizer Corp., 3006 Cold Spring, Baltimore, Md.
Miller Products Co., 7737 Killingsworth, Portland, Ore.
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Monsanto Chemical Co., 800 N. Lindbergh Blvd., St. Louis, Mo.
Morton Chemical Co., 110 N. Wacker Drive, Chicago 6, Ill.

N

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National Chemsearch Corp., P.O. Box 10087, Dallas 7, Tex.
Naugatuck Chemical Naugatuck, Conn.
Niagara Chemical Div., FMC Corp., 100 Niagara St., Middleport, N.Y.
Norda Essential Oil & Chemical Co., Inc., 601 W. 26th St., New York 1, N.Y.

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Pennsalt Chemicals Corp., 2901 Taylor Way, Tacoma, Wash.
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Reade Manufacturing Co., 135 Hoboken Ave., Jersey City 2, N.J.
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Riverdale Chemical Co., 200 E. 17th St., Chicago Heights, Ill.
Robeco Chemicals, Inc., 25 E. 26th St., New York 10, N.Y.
Rohm & Haas Co., Washington Square, Philadelphia 5, Pa.

S

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Southern Mill Creek Products Co., 1906 N. Armenia, Tampa 7, Fla.
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T

Tennessee Corp., 612-629 Grant Bldg. Atlanta 3, Ga.
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U

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The Upjohn Co., 7171 Portage Road, Kalamazoo, Mich.
Utility Chemical Co., 145 Peel St., Paterson, N.J.

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HSAF '63 Convention Program Like College Course in Its Diversity

Program plans for the Horticultural Spraymen's Association of Florida 1963 Convention promise delegates what nearly amounts to a distilled college course in turf maintenance.

Meeting for three lecture-and-panel-packed days Oct. 31-Nov. 2 at Orlando's Robert Meyer Motor Inn, HSAF members will hear noted authorities on such diverse subjects as lawn renovation, citrus spraying, growth retardants, and business management.

Also included on this year's program are the customary basic studies of importance to the membership. These include talks on chinch bugs, nematodes, diseases of ornamentals, common lawn insects, turf diseases, and weed control in established turf.

Field-oriented aspects of the program include an observation of lawn spraying, and an afternoon-long display of equipment, where suppliers will show off their latest machines.

To be repeated this year is the widely praised "panel of pros," in which selected experts who've appeared on the program will answer questions which delegates pose, either as a result of problems encountered by the sprayman in his business, or a question generated by some aspect of one of the lectures. This panel was extremely popular last year.

Of particular interest to some spraymen are the addresses on diagnosing lawn problems by Ralph White of Ousley Sod Co. in Pompano, and a session on fertilizers (organics vs. chemicals; liquids vs. dry) by industryman Charles Butterworth.

Talks on legislation, public relations, and advertising round out the offering for applicators who attend this fourth annual HSAF meeting. As in the past, the convention is open to interested applicators from all over the country. Last year, there were several non-Floridians in evidence.

Meeting Dates

30th Annual National Agricultural Chemicals Assn. Conference, The Homestead Hotel, Hot Springs, Va., Oct. 27-30.

Horticultural Spraymen's Assn. of Florida Annual Convention, Robert Meyer Motor Inn, Orlando, Oct. 31-Nov. 2.

Annual Washington State Weed Conference, Chinook Hotel, Yakima, Wash., Nov. 4-5.

American Society of Agronomy Annual Meeting, Denver Hilton Hotel, Denver, Colo., Nov. 18-22.

Weed Society of America, Pick-Congress Hotel, Chicago, Ill., Feb. 10-13.

Aquatic Weed Control Society Annual Meeting, Palmer House Hotel, Chicago, Ill., Feb. 11-12.

For information about registration or hotel facilities, write HSAF president Walter E. Ferguson, 2500 Ave. J, N.W., Winter Haven, Fla.

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Lawn Clippings Removal Studied

In a 3-year study of lawn management of Kentucky and Merion bluegrass, George A. Beach, horticulturist with Colorado State University, Fort Collins, concluded that although plots where clippings were removed were rated highest on appearance, the difference between ratings on removal and nonremoval was not statistically significant in most cases.

In the experiment, 12 lawn plots were checked each year for 3 years. "In 36 comparisons, 29 showed no significant difference in appearance whether clippings were removed or not," Beach revealed.

Plots were mowed often enough so that only ½ inch of blade was removed at each cutting to bring grass to the desired height, however, and if lawns are not cut this frequently, clippings would probably have to be removed for best appearance, Beach cautioned.

Removal or nonremoval of clippings also may depend on other management factors such as fertilization, Beach explained. "For example, if clippings are not removed and the grass is growing rapidly from fertilization, the abundance of dried clippings may damage the appearance somewhat."

WSA, AWCS Set Joint Session

For applicators who are interested in attending both the Weed Society of America Conference and the Aquatic Weed Control Society meeting in Chicago, Ill., next February, a joint session has been arranged.

Since the WSA meet is slated for Feb. 10-13 at Chicago's Pick-Congress Hotel, and the AWCS will convene Feb. 11-12 at the Palmer House, this joint session has been scheduled to avoid some of the conflict of interests among delegates who wish to attend both meetings.

Program chairman for the AWCS is Dr. John Gallagher, Amchem Products, Inc., Ambler, Pa.; WSA secretary is Dr. G. C. Klingman, Crops Science Dept., N.C. State College, Raleigh, N.C. Those who want more details about either meeting should write directly to either Klingman or Gallagher.

On-the-spot examination of new turf maintenance techniques and chemicals was a highlight of Florida's turf management conference, during which Dr. G. C. Horn (with speaker) guided delegates through several test plots.

Importance for Turfmen of Scientific Knowledge Demonstrated by Record Florida Conference Attendance

Ever-increasing importance of technical know-how for those who are responsible for maintaining fine stands of turfgrass was evidenced this year by a record-breaking attendance at the 11th Annual Florida Turfgrass Management Conference August 27-29, at the University of Florida, Gainesville.

Sponsored by the Florida Turf-Grass Association and the University of Florida's Agricultural Experiment Station and Department of Agriculture, the Conference attracted over 400 delegates from Florida and such widespread points as New York, California, Texas, and all the southern states.

Fields of interest represented this year included horticultural spraymen, lawn service and landscaping agencies, golf course, park and cemetery supervisors, and nurserymen.

During the general session, which featured turf insects, and throughout the professional discussion sections and tour of the turf research areas, every aspect of turf management and research was reviewed by speakers from across the country.

Praise Growth Retardants

Jack Cabler, assistant ornamental horticulturist with the Florida Agricultural Extension Service, reviewed one of the most significant research studies being conducted by the Experiment Stations. Cabler said the use of growth retardants appears very promising. After several more years of testing, these compounds may be available for the homeowner. "It has also been found that growth retardants help grasses grow in shade," Cabler indicated.

Other recent research reveals that lawns fertilized with organic nitrogen are less susceptible to chinch bug damage than those fertilized with chemical nitrogen. Dr. G. C. Horn, associate turf technologist, and Dr. W. L. Pritchett, soils technologist, both of the Florida Experiment Stations, explain that they believe grass treated with organic nitrogen is less susceptible to chinch bugs because organic fertilizers act more slowly than chemical fertilizers.

By **WALTER D. ANDERSON**
Executive Secretary
Florida Turf-Grass Association
Jacksonville

Honors for Florida turf management pioneers included this year the presentation of a FT-GA Award of Honor to James E. Ousley, Sr. (left) for his work with the industry in general, and the FT-GA Trade Show specifically. Here he is congratulated by newly elected group secretary-treasurer, L. N. Clark.

Other significant papers presented at the Conference included "Latest Look at Overseeding," "Rebuilding Gridiron Turf," "The Need for a Turf Specialist in a Cemetery Operation," "Comparisons of Vegetative and Seeded Grasses," "Diagnosing Lawn Problems," and "Weed Control and the Turf Nursery." All papers presented will be published in the Conference Proceedings, available from the FT-GA later in the fall.

A new feature of the Conference was the "Industry Hour," in which representatives of leading chemical and fertilizer firms presented the latest information available on the use of their products in the field of turf. With 300 in attendance for this evening session, the popularity of this program was apparent and plans are to continue it, each year featuring a new aspect of turf interest, such as major equipment, soil amendments, etc.

At the annual meeting following the industry hour, Dr. Gene C. Nutter, Executive Director of the Golf Course Superintendents Association of America, was elected FT-GA President for the coming year. Elected to serve with him were James L. Blackledge, vice-president, Barco Inc., Lake Worth; and L. N. Clark, secretary-treasurer, Director of Parks and Recreation, Jacksonville Beach. Also elected as directors with a three-year term of office were Howard C. Bardsley, F. E. C.

Change of command. Incoming FT-GA president Dr. Gene C. Nutter (left) received congratulations and the symbolic gavel from retiring prexy Ralph W. White.

Know Your Species

WATERHYACINTH

(Eichhornia crassipes)

Waterhyacinth, a flowering, tropical aquatic weed, reproduces by vegetative offshoots from parent plants and by seed. This free-floating weed is found throughout the Gulf Coast region of southern United States where it spreads so rapidly that it clogs inland waterways and prevents navigation for commerce and recreation.

Waterhyacinth was introduced into the United States from South America sometime before 1884. First official account of waterhyacinth was at the New Orleans Cotton Exposition in that year. It bears the nickname of "Million Dollar Weed" in Florida, though cost of its control has long since passed that mark. It is also a pest in areas of California.

A somewhat oval leaf-blade with parallel veins is borne on the end of an inflated bladderlike petiole. It is this bladder which bouys up the plants. Many petioles grow outward in a rosette pattern from a central axis.

Six-petaled flowers are showy and vary in color from white to bluish hues. Many flowers are borne on a single flower stalk which emerges from the central axis. Many tiny seeds are produced, but only about 5% germinate. Enough seedlings may become established in shallow water, decaying vegetation, or on mud along shorelines to reinfest bodies of water from which all waterhyacinth plants have been eliminated.

Waterhyacinth has a densely fibrous root system which dangles in the water but may become attached to mud for a time during periods of low water.

Underwater rhizomes, submerged stemlike structures, are the major means of this weed's spread. After a lateral growth of about six inches away from a parent plant, the rhizome sprouts a new plant. Ten individual plants can cover an acre of water after ten months growth. It is the rhizomes which bind mats of parent plants and offshoots together and restrict movement of watercraft through infested streams.

When a mat of waterhyacinth covers a stream, it so shades out sun that no other plants grow, and in shallow areas the oxygen may be so low under the mat that no fish survive. Mats block water flow and have been known to cause sewage backup in Florida. Matted plants, at times, float downstream and jam against bridges. Many mechanical and chemical controls have been tried; 2,4-D has been the most successful chemical used to date. However Amitrol-T and Diquat have recently been shown to be effective. Chemicals are applied as foliage sprays in a continuing program to eliminate this pest at its source.

Prepared in cooperation with Crops Research Division, Agricultural Research Service, United States Department of Agriculture, Beltsville, Maryland.

Fertilizer Co., Homestead; William Colburn, Superintendent of The Bay Hill Club, Orlando; and J. Leroy Fortner, Superior Fertilizer Company, Sarasota.

During the annual banquet on August 28, Cary Clark, turf management major at the University of Florida received the second FT-GA $500 scholarship.

Numerous awards were made at the banquet to Floridians who have played a prominent role in turf over the years. Foremost of the awards was the presentation to James E. Ousley, Sr., of Pompano Beach, an FT-GA Director and 1962 Trade Show Chairman, of the first FT-GA Award of Honor, in recognition of his meritorious service to the Florida turf industry.

Aquatic Weed Control

(from page W-17)

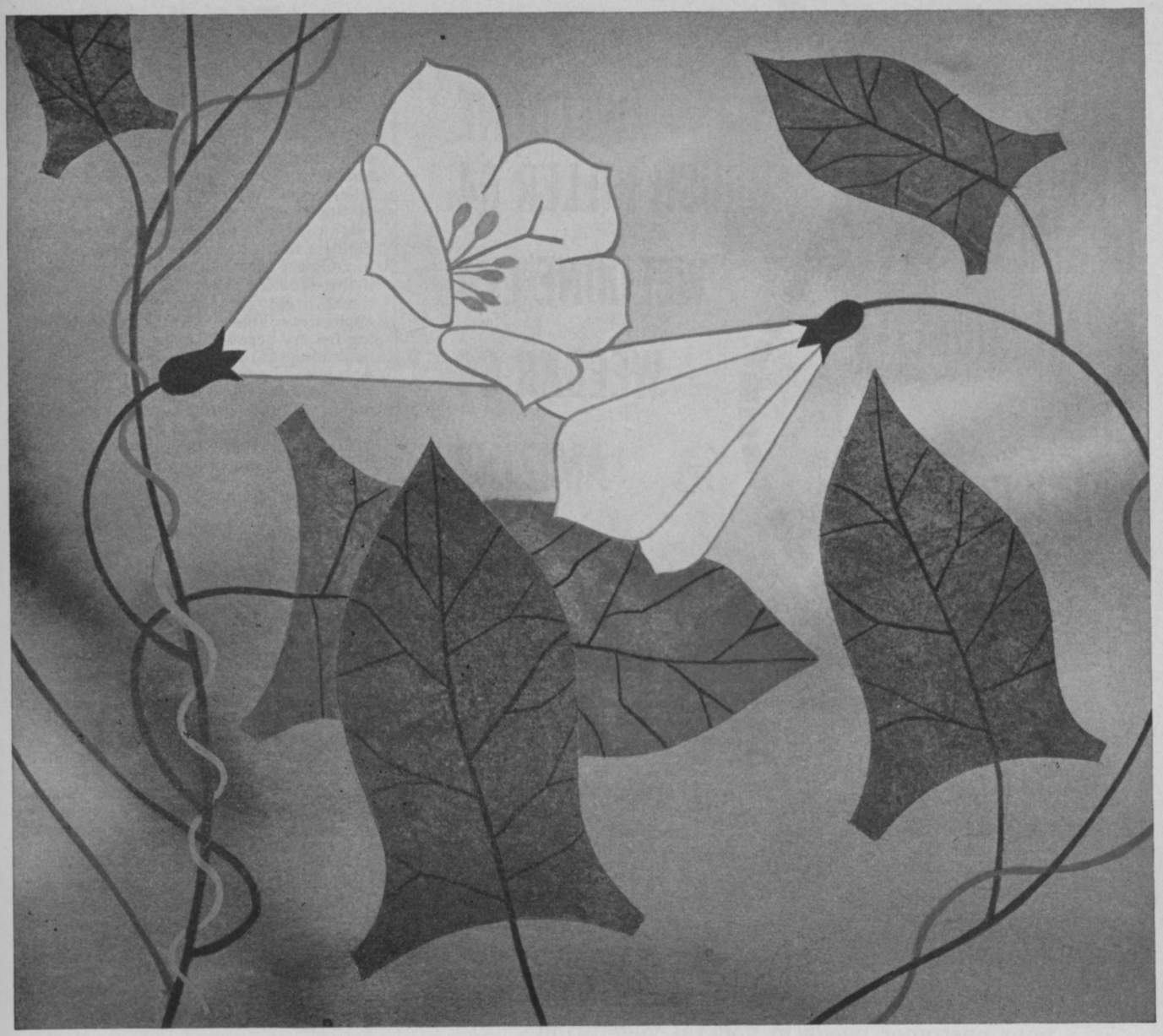
single midrib vein on each leaf from which small lateral veins are given off. Overall venation may be obscured by the smooth fleshiness of leaves. *Nyphaea* or white waterlily, on the other hand, has veins which radiate evenly from the petiole point of attachment. Identification of leaves can be used when plants are not flowering.

Nuphar's sparsely petaled flower will be yellow; *Nymphaea's* many-petaled flower will be white, rarely yellow, pink, or blue. After petals have dried and fallen, the globular seed receptacles will look alike on both species, so leaf venation identification again should be used.

Although Nymphaea is considered a true floating-leaf aquatic, some species of *Nuphar* are more erect. Stout petioles lift the arrow-shaped leaves out of the water.

The aquatic plants previously discussed do not constitute all pest species encountered. At one time or another, any number of species may become sufficiently plentiful to be bothersome. This listing is intended to offer a brief cross section of the more troublesome species at present.

Chemicals for control of these plants will be dealt with in the second installment of this series, which appears next month; equipment for application will appear in the final segment of this three-part article.



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Trimmings

Nostalgia Department. **We were reminiscing recently about some of the many contract applicators who corresponded with us during the months of intensive poll-taking and research which preceded the establishment of *Weeds and Turf,* and were pleased to come across a memo from Archie Wheaton, who is supervisor of the Lucas Tree Expert Co., in Norridgewock, Maine. Archie wrote us that his firm felt it had achieved real success in contract brush control, and wondered if the aquatic field might not offer additional bright opportunities for diligent applicators. This was timely wool-gathering for us, because this issue marks the beginning of our three-part article on water weed control. Hope Archie enjoys what our technical staff has to say . . . and if anyone wonders why we waited until now to publish the article, suffice it to say that this was a most *ambitious* endeavor, and was a long time in preparation!**

* * *

Business will be booming. Perhaps it's not something to approach with levity, but we've learned that a group of atomic experts predict that should a nuclear war come about, it is probable that a hardy survivor will be our old nemesis, crabgrass.

* * *

The Page boy's job. **Speaking of applicators with broad fields of interest, while we were musing over some of the letters from CAs which came during the early days of the magazine, we found a communique from Jack Page, who runs Jack Page's Nursery in Walla Walla, Washington. Jack tells us his company has a spray service, does landscape work, and operates a nursery as well, and said he looks forward to the technical information W&T offers him each month. Jack's a landscape architect himself, and we hope this Page finds what he's looking for on *our* pages!**

* * *

Kilmer Oak to fall. Looks like Rutgers University in New Brunswick, N.J., is going to lose its famed Kilmer Oak. The majestic tree, several years in decline and now dead, is popularly thought to have inspired Joyce Kilmer's famous poem, "Trees." There's a lot of sentiment connected with the fine old oak, which once stood 68 feet tall and had a limb spread of 108 feet. Job of removal went to Eugene Pendolino of Garden State Tree Specialists in North Plainfield, N.J. Gene's only compensation, our news correspondent says, was a crosssection of the trunk which he wants for an office decoration. (Requests for crosssections have been widespread.) The tree was slated for demolition last month.

* * *

Turfgrass honors. **Our turf management friends in Florida like to give awards, it seems, and the latest bevy of prizes was handed out at the recent turfgrass conference (p. W-35). Honored for outstanding service to the industry were Ed Miller and Dewain Railey, researchers at the University of Florida, and Cliff Rasmussen, who's experimenting on turf at the experiment station in Ft. Lauderdale. Also cited were industry figures Howard Bardsley of Homestead and Dave Turner of Ft. Lauderdale. Often-honored Col. Frank Ward, a former FT-GA leader, received commendations, too. Congratulations to all!**

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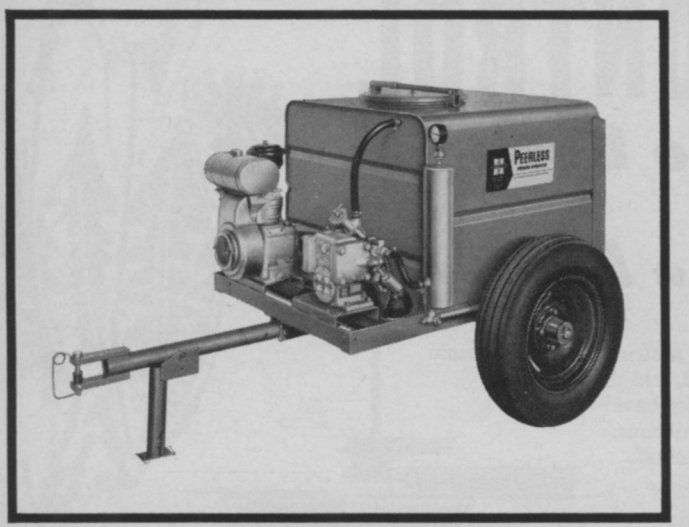
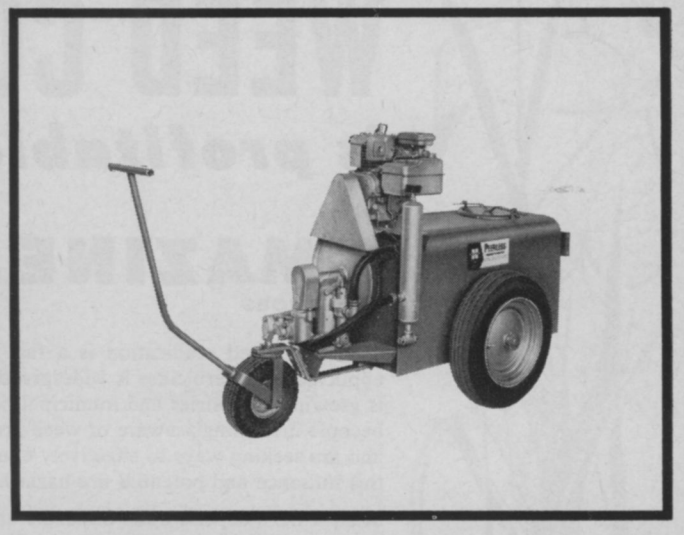
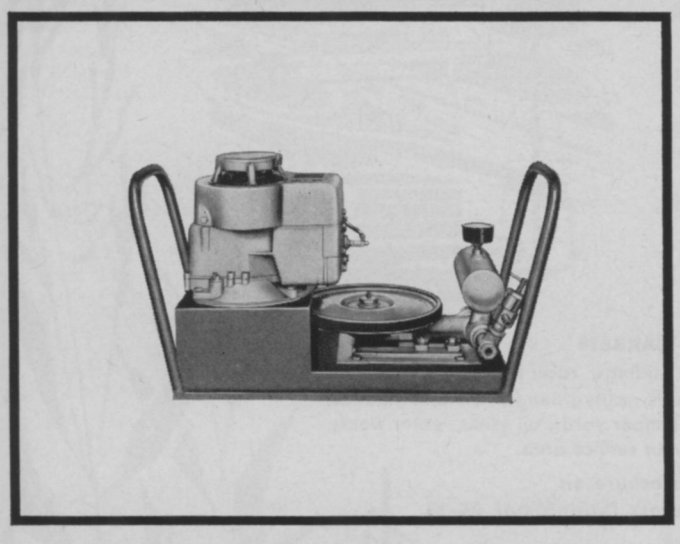
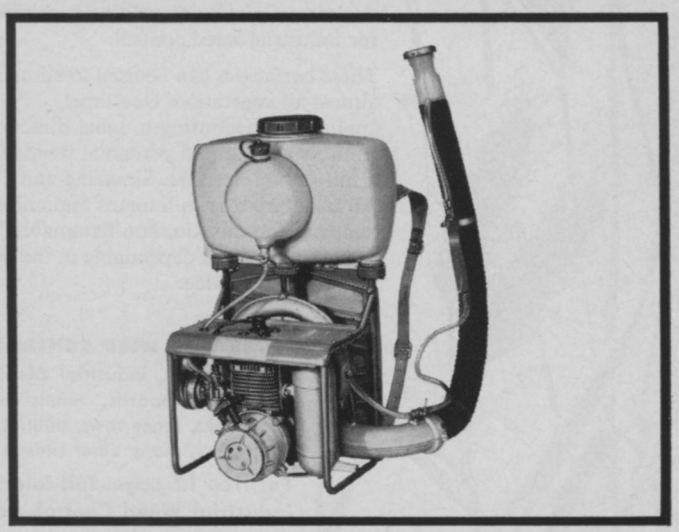


Peerless compact power sprayer handles any sprayable materials with pressures up to 400 pounds and at five gallons per minute output. Compact size and three wheel design provides exceptional maneuverability; easy to move by hand into places other high output sprayers cannot go. Two-wheel and skid models in 50, 100, 150, and 200-gallon tanks with either stainless steel or Endurall® bonded liners. Also Matador,® 15 to 100 gals.





Porta-power spray pump combines high output performance with unrestricted range in a moderately priced unit. Carry it on your pick-up truck; take it in a boat. Pump from barrels, tanks, or any other type of container. Positive piston pump handles all sprayable materials. Porta-power pumps are available in models with outputs of five gallons per minute at 400 pounds or three gallons per minute at 250 pounds.



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