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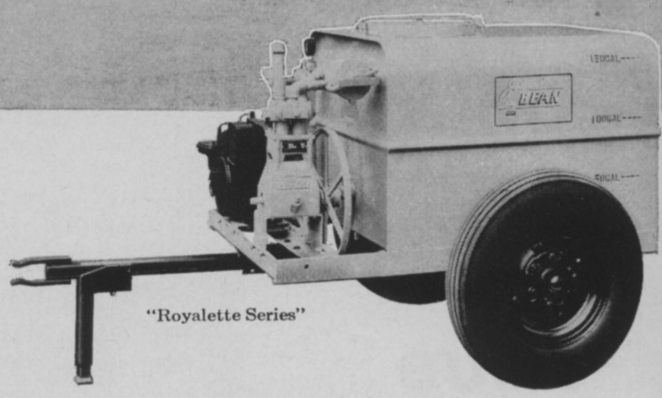

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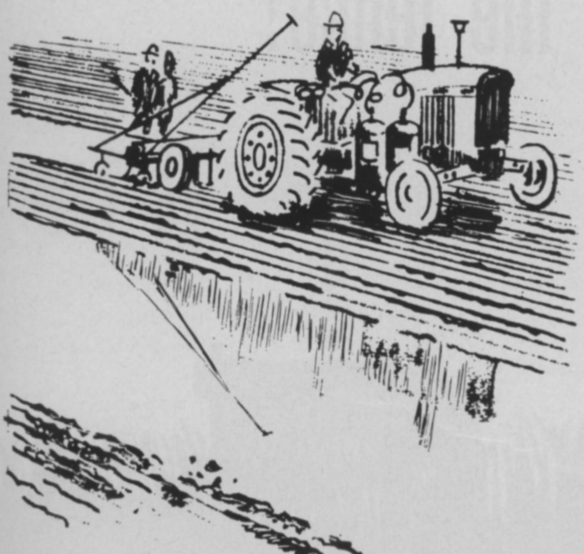

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Speak up now!

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.

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 manmade 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

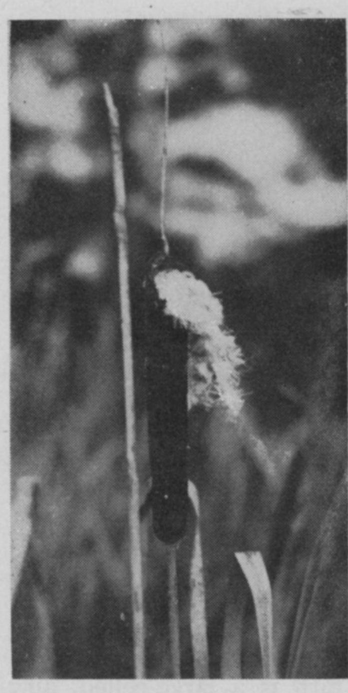
Another slender-leaved emersed species is bulrush, *Scirpus* spp. *Scirpus* is a member of the sedge family, Cyperaceae; it is not a true rush. Bulrushes are generally characterized by rounded or three-angled stems. Insides of stems are solid, contrasted with true rushes which have round and hollow,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

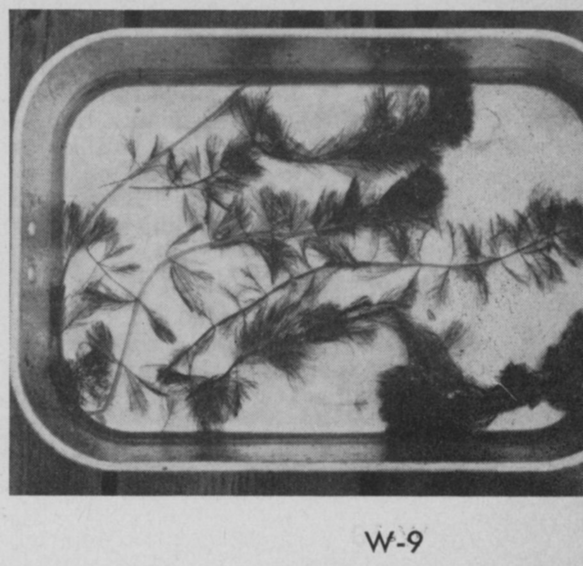
There are many other species of bulrush distributed throughout the United States. They are recognized by a rounded or triangular stem, sheathed leaf

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