More recently, treatment of fairways and roughs become practical with the design and construction of new, larger injection machines. These tractor injectors travel up to six miles an hour, enabling fairways and roughs to be treated twice as fast as greens. Though the knives do some damage to turf, recovery is usually rapid.

"Sometimes you can see some little streaks for as long as four weeks or more. If the turf is in poor condition, the streaks may be apparent for a couple of months," Horn said.

So effective is the nematicide treatment, said Horn, that an observer can see where the injectors entered the soil and where they were extracted. "If the applicator skips a three-foot swath, for example, you can pick out those three feet. Six months or a year later, you can still find the misses."

Golfing is big business in Florida, and Dr. Horn said about 40 courses a year are being added to the existing 650 courses. He estimates that 60 to 70 per cent of the greens and about 25 to 30 per cent of the fairways are being treated annually with a nematicide. Horn estimates that about 10 per cent more courses will be treated with Fumazone nematicide this year, with perhaps another 15 to 20 per cent the following year.

"There are very few public, municipal or private golf courses in Florida that haven't at least treated some of the greens," the consultant said. "Treatment had not been this extensive on fairways, however, if nematodes exist in numbers sufficient to cause damage, the turf does very poorly and should be treated."

Cost of treating greens in Florida is about $7 or $8 a thousand square feet. Horn said a superintendent can get by fairly well with treatment of putting surfaces alone. "But, again, it gets back to the fact that if you treat the green and not the immediate surrounding area, you're going to have a good looking green and poor slopes."

Use of a nematicide throughout a golf course in Florida ranges from $3,000 to $9,000. Yancey said the treatment cost at Ocala is about $3,500 a year.

Horn recommends treatment where known nematode problems

(continued on page 52)

Jim Yancey proudly points out the well-manicured turf on green number 4 at his golf course in Ocala, Fla. Yancey, club pro and greenskeeper, is the older brother of professional golfer Bert Yancey.

Sod Production in

By ROY L. GOSS
Agronomist
Washington State University

Sod production began in Washington, the first Pacific Northwest producer, in 1962. Emerald Turfgrass Farms at Sumner, Washington was the first producer that has stayed in business and had its beginning on 25 acres. At the present time Emerald operates about 250 acres of cultivated and specialized sod and stolons. It is estimated that there are seven or eight producers growing about 1,000 acres of cultivated sod. Perhaps there are several reasons why sod production isn't a larger industry when compared to Michigan.

First of all, the Pacific Northwest has a very friendly climate for the establishment of lawns from seed. Lawns can be planted in any month from April 15 through October 20, particularly in the metropolitan areas of Seattle and Tacoma, WA, and Portland, OR.

Secondly, there are few pests in the way of seedling diseases and weeds to prevent good establishment of seeded turf. Although crabgrass is found in nearly all areas of the Northwest, it is not a serious problem to the establishment of turf. Summer turfgrass diseases are not significant to the manager of fine turf.

Winter losses of turfgrasses in the Northwest is not a significant problem except in the interior regions where colder winters causes variable losses from snow mold and occasionally winter desiccation.

Along the Pacific coast, losses are not highly significant and are related to minor Fusarium Patch disease losses and only rarely to winter desiccation. Well-designed and applied fungicidal programs help to make disease losses rather minor in all areas. Perhaps another reason, and perhaps the most significant for the lack of demand for good sod, is public awareness and promotion. Although sod production has increased more than 50 percent within the last five years, it is still in its infancy in the Pacific Northwest.

In Canada there are probably no more than a dozen sod producers West of Saskatchewan. If we wish to consider Alberta as a part of the Pacific Northwest, their major producers lie in the Calgary-Edmonton area. Even so, the total production of both Alberta and British Columbia probably do not exceed 1,000 acres of cultivated sod.

TYPES OF TURF GROWN FOR SOD

Bluegrass is the principal sod type produced in all areas of the Northwest. The principal varieties include Merion, Fylking, and Baron, with increased emphasis on Nugget in the colder interior regions of the Northwest.

Any of the named varieties of bluegrass in combination with the fine-leaved fescues make up the largest acreage of cultivated sod. Pennlawn, Illahee, Rainier, Dawson, Jamestown, and Wintergreen are the major varieties used in these mixtures. Some producers include up to 30 percent of the total seed mixture as fine-leaved fescues to compensate for shade tolerance that many of the bluegrasses, in general, lack.

More recently, mixtures of the bluegrasses and turf-type ryegrasses such as Manhattan and Pennfine have gained popularity for specialized uses such as athletic fields, playgrounds and park areas. Winter hardiness of the ryegrasses has not been a problem in the western portion of the Northwest, but have not proven to be highly popular in the colder interior regions. Ryegrasses maintain better growth and color during the fall and winter months west of the Cascade Mountains, hence, the popularity for this type of mixture. Red thread disease caused by the fungus *Corticium fuciforne* is probably the greatest weakness of the ryegrasses along the West Coast area.

Stolon production is very limited. To my knowledge, only Emerald Turfgrass Farms produces stolons for specialized uses on golf course putting greens. The variety Toronto is the only stoloniferous type produced, however, some Old Orchard is shipped in from California producers.

SOIL TYPES FOR SOD PRODUCTION

Nearly all sod in the Pacific Northwest is produced on mineral type soils. Soils vary from loamy sands to silt loams. Little or no production occurs on peat or muck soils. Sod producers on the Northwest coast experience heavy rainfall during fall, winter and early spring, making peat soils difficult to manage during this period of time since mowing must be practiced in nearly all months of the year.

Although it requires more time to produce a saleable crop of sod on lighter soils, harvesting operations can proceed at any time the ground is not forzen or snow covered. This is not a significant factor west of the Cascade Mountains, although no harvesting occurs in areas east of the Mountains from, perhaps November 1 through April 15.

PRODUCTION AND HARVESTING

Sod fields are normally planted at the rate of 70 to 100 lbs. of bluegrass or bluegrass/fescue mixtures per acre. Brillion drills are predominately used for planting. No sod is reproduced from rhizomes or other vegetative material.

Fertilizers are applied prior to planting based upon soil tests. Normally preplant applications of 10-20-20 at the rate of 400-500 lbs. per acre are provided, after which nitrogen only is applied to produce the crop.

Nitrogen applications are made every five to eight weeks throughout the growing season to maintain vigorous growth and development. The average sod crop on sandy soils receives about between 250 to 275 pounds of nitrogen per acre before harvesting. Liming is practiced only on acid soils west of the Cascade Mountains where soil tests indicate the need.

Most irrigation is practiced with either portable handsets or portable wheel moves. Little solid set irrigation except for establishing new fields is practiced in the Northwest. Some farms practice laying out solid sets on newly seeded fields until they are ready for the first mowing, and then removed and replaced with wheel sets.

the Pacific Northwest

Mowing is usually accomplished with pull-type units of 5, 7 or 9 gangs. Some producers in the higher rainfall areas west of the Cascade Mountains use very high flotation tires on tractors used for gang units, fertilizer application, or other operations in the field. Rear tires up to 42 inches wide make mowing operations possible when soils are soft and wet.

Harvesting is accomplished with a wide variety of equipment. Some smaller farms cut with 18 inch hand operated power cutters while others use the Nunes, Brouwer, or Princeton sod harvesters.

MAJOR PROBLEMS

Poa *annua* is by far the single most important problem in sod production. All fields planted to premium quality sod must be fumigated with methyl bromide at 300 lbs. per acre prior to planting. This costs the sod grower about $300 an acre by the time the tarps are retrieved from the land. Even this does not guarantee freedom from Poa *annua* invasion. Some tests have been made with tricalcium arsenate as a post-emergent eradication treatment with varying success considering variable soil types and soil drainage.

The sod producer has little control over the destination of the grass grown, since little sod is installed by producers. Frequently, bluegrasses are sodded in areas with too much shade and results in unacceptable lawns and occasionally complete losses. Bluegrasses sodded on putting green aprons produces a striking contrast with fairway types and is sometimes criticized.

Soil incompatibility on high use playfields is frequently a problem. The better football fields in the Pacific Northwest today are built from sand and organic material. Sod grown on soil heavier than loamy sand does not readily transmit precipitation unless intensively managed. Some producers are presently growing sod on sand which has been hauled in for premium quality athletic fields. This obviously increases the price of the sod to the consumer, but many feel this is a wise investment.

One other problem facing sod producers in the metropolitan areas of Seattle and Portland is high land costs and taxes. Land suitable for sod production in these areas is valued from $2,000 to $7,000 per acre. Land rent for the same land runs from $80 to $100 per acre with the renter participating in part of the taxes.□

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meeting dates

Purdue University Weed Day, summer tour, Purdue University Agronomy Farm, W. Lafayette, Ind., June 25.

American Society of Landscape Architects, 74th annual meeting, American Hotel, Bal Habour, Miami Beach, Fla., June 30 - July 4.

International Drip Irrigation Congress, 2nd annual meeting, San Diego, Calif., July 7-14.

American Association of Nurserymen, annual convention, Four Seasons-Sheraton Hotel, Toronto, Ont., July 13-17.

Hyacinth Control Society, Inc., Langford Hotel, Winter Park, Fla., July 14-17.

American Sod Producers Association, summer meeting, Sheraton Inn-Northeast, Washington, D.C., (New Carrollton, Md.) July 16-19.

Turfgrass Research and Equipment Field Day, University of Maryland Plant Research Farm, Fairland, Md., Aug. 8.

Ohio Turfgrass Field Day, Ohio State University, Columbus, Ohio, Aug. 8.

American Society for Horticulture Science, 71st annual meeting, and **Canadian Society for Horticulture Science,** 19th annual meeting, University of Guelph, Ont., Aug. 11-17.

International Shade Tree Conference, Golden Anniversary meeting, Atlanta, Ga., Aug. 18-23.

National Hardware Show, 29th annual show, New York Coliseum, New York, N.Y., Aug. 25-29.

Professional Grounds Maintenance Society Conference, annual meeting, Crown Center Hotel, Kansas City, Mo., Sept. 4-6.

International Plant Propagators' Society, Western Region, 15th annual meeting, Mission Bay area, San Diego, Calif., Sept. 4-6.

Northern Michigan Turfgrass Field Day, Michigan State University Experimental area, Sept. 10.

Lawn and Garden Distributors Association Convention, annual meeting, Fairmon-Roosevelt Hotel, New Orleans, La., Sept. 11-12.

Florida Turf-Grass Association, combined conference and show, Curtis Hixson Convention Center and Riverside Hilton, Tampa, Fla., Sept. 16-19.

Midwest Agricultural Chemicals Association, annual meeting, Four Seasons, Lake Ozark, Mo., Sept. 17-19.

International Pesticide Applicators Association, Seattle, Wash., Sept. 18-21.

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Hyacinth Control Society Meets July 14-17

AQUATIC WEED management and research will highlight the '74 annual meeting of the Hyacinth Control Society at Winter Park, Fla., July 14-17.

Headquarters will be the Langford Hotel, a block from the downtown Winter Park area. Activities begin Sunday evening.

This Society is the only major group in the nation which devotes its total program to aquatic weed programs. The formal sessions include both technical research and field experience presentations. In fact, the group has been forced to develop a program of concurrent sessions during each afternoon. One session is devoted to technical data, the other to operations and field techniques. General sessions will remain the norm for the morning programs.

Aquatic plants become more and more important during recent years in areas other than the Southeastern US and both the program and the attendance reflect this change. Members and guests attend from throughout the US and several foreign countries each year.

Anyone concerned with aquatics is welcomed by the membership. Registration is $35. Wives may attend for an additional $15 registration fee. The Board has authorized a 10% discount on these fees for preregistration prior to June 30. Checks may be sent to the Society secretary, T. W. Miller, Jr., Post Office Box 2237, Fort Myers, Fla. 33902.

Hotel registrations may be made direct to The Langford Hotel, E. New England Ave. and Interlachen Ave., Winter Park Fla., 32789. Single rates begin at $16.50 with $5 for each additional person. A deposit is required to guarantee space.

Cancellations will be refunded for registration until July 10 and by the hotel until 48 hours prior to the meeting.

Details can be obtained from Dr. Alva P. Purkhalter, president of the Society, and also in charge of local arrangements. His address is Department of Natural Resources, Larson Building, Room 595, Tallahassee, Fla. 32304.

Dawn Attack . . . On Hydrilla

By DOUG JONES, Applied Biochemists, Inc., Mequon, Wis.

Hydrilla, a prolific strangler of Florida's inland lakes and waterways, continues to resist control efforts.

Those attending the Hyacinth Control Society convention in Winter Park, Florida, July 14-17, will learn first-hand of progress to date in hydrilla control.

Applied Biochemists, Inc., a Mequon, Wisconsin firm, was among the first (starting in 1970) to engage in serious testing for a chemical control of hydrilla. The story Applied Biochemists, Inc. will tell in Winter Park is that of the new CUTRINE-PLUS, its vastly improved copper triethanolamine, algaecide which, in combination with Diquat or Aquathol-K, has become important in hydrilla control.

Since hydrilla came to the forefront as an aquatic crisis problem, chemicals have shared the experimental spotlight with insects, fish, and mechanical devices in an all-out effort to control its spread. (WEEDS TREES and TURF, October, 1972, reported an isolated hydrilla infestation in an Iowa farm pond.)

Each type of control has shown some promise, and more work is needed. Chemicals appear to show the most immediate success in at least controlling growth.

Buying time while maintaining a year-to-year plant knockdown is perhaps a better way to state the assumption.

The CUTRINE testing program was conducted with the cooperation of Robert "Doctor Bob" Blackburn and his U.S.D.A. associates at the ARS station in Fort Lauderdale, Florida. Blackburn has expanded his work to include other chemicals and chemical combinations, and will report on his work at the Winter Park meeting.

Field tests on CUTRINE and Diquat were conducted in 1972. Using a combination of four gallons of CUTRINE and two gallons of Diquat per acre, applied by dragging hoses along the bottoms of lakes and across hydrilla beds, good results were obtained. In the test plots, observed by scuba divers, the combination showed an average of 83 percent control of hydrilla after 30 days.

Attesting to the severity of the problem, following a positive result observation after 60 days, little control was noted after 90 days. So, while the CUTRINE/Diquat system provided excellent short-term results at economical cost per acre rates, and with little or no harmful effects on invertabrates which make up the fish food chain, it was obvious a perfect solution was not yet at hand.

In 1973, Applied Biochemists, Inc. received federal registration for CUTRINE-PLUS, a more stabilized copper complex which has proven to be 50% more effective than CUTRINE. The product contains 9.0% active copper compared to CUTRINE's 7.1%, reduces cost per acre treated, and eliminates the sulfates which some users had found objectionable.

Armed with a better, less costly weapon, Applied Biochemists, Inc. contacted the major governmental and private agencies responsible for

aquatic nuisance control, and the stage was set for the 1974 hydrilla control season.

Early reports are that both the CUTRINE-PLUS/Diquat and CUTRINE - PLUS / Aquathol-K combinations are working well. The latter method was first tested in the summer of 1973 with the expected mixed results. More definitive data will come from another season in the field and, if the combination proves as predicted, it will provide even greater economies in treatment.

Basically, it is recommended that 3-1/3 gallons of CUTRINE-PLUS be combined with two gallons of Diquat for hydrilla control, a cost of approximately $90 per acre foot. Due to the increased compatibility of CUTRINE-PLUS with Diquat, it may be possible to reduce the ratio to 1 ½ gallons of CUTRINE-PLUS to two gallons of Diquat, and a $70 per acre foot cost. Experimentation by the user will result in the best combination.

Two gallons of CUTRINE-PLUS and two gallons of Aquathol-K is standard for hydrilla control at a cost of $45-50 per acre foot. Again, experimentation will prove the key.

In all cases, above costs should be tempered by the steadily increasing cost of chemicals. However, these combinations at this time provide the lowest cost for treatment. Method of application likewise varies with the type of water body to be treated.

For example; the massive and extensive canals and waterways in Florida have raised the question as to the fastest and most efficient method of treatment. In the southeastern section of the state, one answer has been the helicopter.

A nurse truck, loaded with premixed chemical, is used for tank refill on one of Southeastern Heliocopter Service's choppers. The truck follows landward as the aircraft treats the weed-choked canals.

Early treatment of hydrilla by helicopter, using CUTRINE-PLUS and both Diquat and Hydrothol-K, has proven to be efficient.

The procedure consists of a helicopter pilot and crew usually beginning at daylight. On the day prior to treatment, a tank truck is loaded with premixed chemical. It follows landward as the aircraft treats the weed-choked canals. Weight is an important factor for the helicopter, with an 80-gallon chemical load about maximum for each series of passes. The 80 gallons amount to about 720 pounds, and often the pilot will carry only enough gasoline to fly that much material on the canal.

Thus, frequent re-loading, both of chemical and gasoline, are required, since the helicopter is rigged with only a 10-foot wide application boom.

Surface craft treatments, many times involving air boats, are common and usually accomplished by using the invert or bivert applications.

Invert and bivert methods, in which the chemicals are mixed with an oil-based emollient, eliminate drift problems. The chemical is released through hoses trailing the boat. Some applicators prefer releasing the chemical several inches below the water surface, allowing the weight of the chemical to drop throughout the water spectrum. Some prefer dragging across the plants at the bottom. Either way, the oil emollient permits the active chemical to cling to the hydrilla.

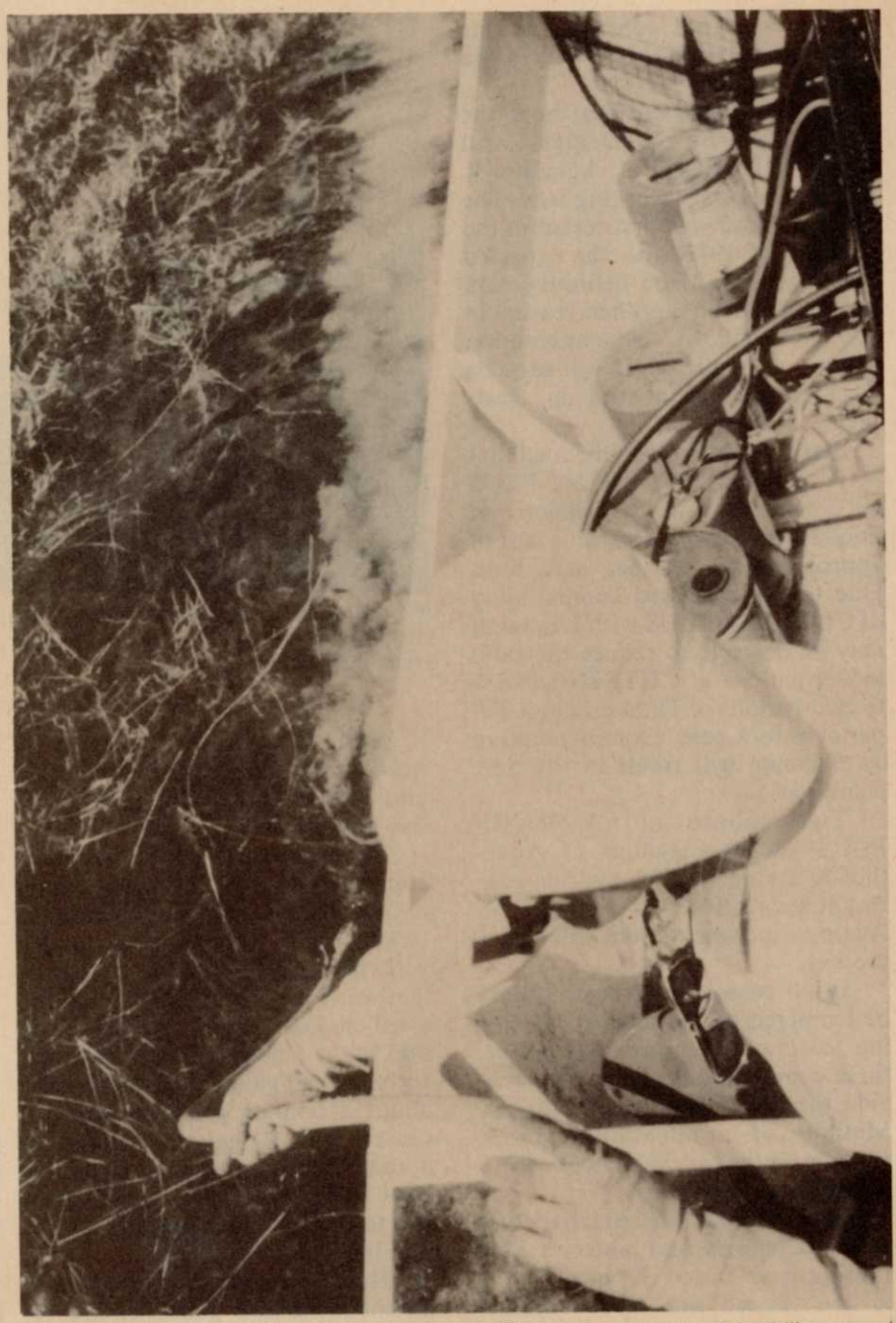
Spray treatment is the oldest method, and is still widely used. Vinnie Diaz, aquatic weed foreman for the city of Margate, Florida, is one who utilizes this method with great success.

For hydrilla control, Diaz makes 200-gallon batches of CUTRINE-PLUS and Diquat on a 5:2 ratio, diluting with water. Using a John Bean rig, he can cover two acres of water, spraying from the shoreline out.

Diaz also has had good results applying CUTRINE-PLUS by itself for control of chara, the weed-like bottom attached algae. He mixes 1.2 gallons of CUTRINE-PLUS in 100 gallons of water, enough to spray one acre.

He reports "great" results on both chara and hydrilla. The chara is normally controlled within two weeks, hydrilla knockdown occurring within a few days.

In general, those who are using a CUTRINE-PLUS/herbicide combination in Florida this year are experiencing hoped for results in about two weeks.



The Broward County (Fla.) Water Resources Department applies a hydrilla-control chemical mixed with an oil-based emollient. Surface craft treatments using the invert or bivert methods eliminate chemical drift problems.