Factors Affecting A Spray Application

By O.W. (RED) KROMER

To have a successful spray application, a number of factors must be considered. Controlling these factors is more important for a herbicide application than for applying insecticides or fungicides. These factors are:

1. Nozzle spray pattern and discharge rate.
2. Boom and hose capacity.
3. Accurate pressure control.
4. Speed of travel.
5. Chemical and water mixtures.
6. Spray swath overlap or skip.
7. Boom stability and boom height above the target area.
8. Wind and climatic conditions.
9. Timing.

Nozzles wear with use which increases their discharge rate and narrows their spray fan. This can happen quite quickly with the old style fan nozzle with a sharp oval shaped orifice. The flooding type fan nozzle will retain its accuracy and fan width much longer. It also produces larger droplets which are less affected by wind. The larger droplets also give better control of broad leafed weeds by actual University tests.

The boom and hoses should be of sufficient size and smoothness so that all nozzles will discharge the same quantity of fluid. This becomes increasingly critical for higher gallonage applications. For low pressure spraying, 30 to 60 lbs., a low pressure regulator must be used. A high pressure regulator is not sensitive enough for low pressure work. If the sprayer has the pump and hose capacity for high pressure use (500 to 600 lbs.) then both high and low pressure regulators should be used in the system with valving, so either system can be used. A sprayer of this type with a piston pump is useful for cleaning machinery, tree spraying, fire fighting, etc.

Accurate travel speed is essential for a herbicide application. A good slow speed speedometer (0-10 m.p.h.) would be very helpful. This speedometer can be obtained as a sprayer accessory and is equipped with a small rubber tired wheel which can be mounted against any wheel that rolls on the ground — even cleated tractor tires — and will register accurate ground travel speeds.

Chemical and water mixing must be done accurately especially when topping off a partially filled tank. Spray swath skip or overlap is especially difficult to control. For accurate application, the outer nozzle on the boom on the return trip would have be held 20 inches over from its previous position — for a boom with 20 inch nozzle spacing, this is impractical under field conditions. For agricultural spraying, with sensitive grain crops, a die marker is used. However, for golf course use this would be objectionable. Therefore, as grass is not as sensitive to the spray chemical as grains it is better to overlap the spray swath.

The boom should be held rigid when spraying. It should not be free to swing. Also it should be held above the spray target at least 20 inches so the nozzle pattern can spread to give a uniform coverage.

Wind and climatic conditions can have a detrimental effect on spray application. For weed control, a clear, warm, sunshine day with no prospect of an immediate shower are ideal conditions. Timing refers to the growth stage of the weed when the spray application will be most effective.

A word on the use of a hand gun for spraying greens or other broadcast applications. For an accurate application, a hand spray boom should be used and be at least 20 inches above the spray target unless 10 inch nozzle spacing is used. Then the boom could be 12 inches above the target. The support wheels for the spray boom should be one-half the spray nozzle spacing beyond each end nozzle. Then you can use the wheel tracks as a guide on the return trip. A pressure gauge should be on the hand spray boom to indicate the pressure there.

Alarmed About Armadillos?

By WAYNE R. MARION
Extension Wildlife Specialist

Armadillos are rather unusual looking animals that belong to a family of mammals found primarily in Central and South America. The earliest fossil ancestor of our North American armadillo is from the Paleocene; it was as large as a rhinoceros. Our present-day armadillo, *Dasypus novemcinctus*, is much smaller; adults normally weigh from eight to 17 pounds. The species ranges from Texas eastward throughout the South; its range is expanding rapidly northward into Missouri and eastward into South Carolina . However, cold weather will limit the further expansion of the northern boundary of the armadillo's range.

Description

Armadillos have a shield-like shell that is covered with horny scales. Joints in the shell are flexible, which enables the animal to bend and twist. Only the ears and belly of the armadillo are without bony armor. These peculiar animals have 28 to 32 peg-like teeth in simple rows well back in the mouth. There are no front teeth. Armadillos have poor eyesight and hearing, but a keen sense of smell. Both male and female are about the same size, look alike, and have similar habits.

Reproduction

Although armadillos may breed in late July, the five-month gestation period is somewhat delayed which results in the young being born in February or March. Only one litter is produced each year, and it always includes four identical young of the same sex. The young look like the adults except that they are smaller and their armor coat remains soft and leathery for some time, becoming harder with age.

Typical Habitat

Armadillos inhabit dense shady cover, such as brush, woodland or pine forests. They frequently rest in a deep burrow during the day and become much more active during the night, early morning, or late evening. Burrows which are located under brushpiles, stumps, rockpiles, or dense brush, are usually seven to eight inches in diameter and up to 15 feet long. Armadillos usually have several burrows and depend upon their ability to escape danger by running to the nearest burrow. Despite their awkward appearance, armadillos are agile runners and good swimmers — and even have the ability to walk underwater across small streams.

Feeding Habits

These animals feed primarily on insects and invertebrates, including ants, grubs, and earthworms. Armadillos usually root or dig in ground litter in search of food, but will occasionally eat berries and mushrooms. Reports of armadillo damage to birds' nests on the ground are rare.

Damage Caused

As a result of foraging activities, armadillos dig numerous burrows and holes in lawns, flowerbeds, gardens and pastures. The burrowing in pastures poses a potential hazard to cattle. Armadillo damage, which is both costly and unsightly, has caused increasing concern for homeowners, farmers, and ranchers. Armadillos are, to some degree, beneficial because they eat insects and larvae. But to most people, these animals are a nuisance to private properties. There are a number of ways of controlling damage by armadillos.

Methods of Control

If armadillos are causing damage to yards, flowerbeds, or shrubbery, it may be necessary to initiate preventive measures or to control local individuals or populations to reduce the damage. Preventive and control methods suggested include:

1. chemical treatment of soils to reduce the local food supply,
2. use of repellents,
3. erection of barriers (e.g. fences),
4. use of live traps for capture and relocation
5. fumigation of burrows, and
6. shooting of offending individuals.

Since the use of chemicals such as chlordane and heptachlor, and the use of steel traps has been legally restricted, control measures must be modified accordingly. A chemical which discourages armadillos from digging in lawns and gardens by killing insects is diazinon (available in granular form with either 5% or 10% active ingredient). Diazinon, used at a rate of 40 pounds of 10% granules or 80 pounds of 5% granules per acre on lawns and around gardens, usually provides considerable relief from the digging activity of armadillos. For best results, these granules should be applied just prior to a rain, or the treated area should be thoroughly watered soon after treatment. All children and pets should be kept off the treated area until it has completely dried. It takes about two weeks following treatment for granular diazinon to become effective. In using this chemical, be sure to follow all precautions and restrictions on the label.

It has been suggested, but not thoroughly tested, that moth

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balls sprinkled in the yard or garden are effective as a repellent for armadillos. Also, where the damage is localized, small fences (10-12 inches high) may be used to keep the animals out.

Armadillos can be trapped in live traps (such as available from Havahart, P. O. Box 551, Ossining, NY 10502) or in homemade box type traps. Animals caught in these traps can be released unharmed into another area several miles away. Traps should be located near the entrance of armadillo dens or burrows and baited with spoiled or overripe fruit (e.g., apples, pears, etc.). If other species of animals get into these live traps, they can be released unharmed.

Fumigating burrows with toxic gases is another technique to reduce armadillo damage. This technique, however, is suggested only as a last resort due to the secondary poisoning hazard for other animals (gopher tortoises), lizards, snakes), which frequently seek shelter in burrows. The fumigation technique to control armadillos is usually chosen only if the burrow or den is located a short distance from the site of the damage. The armadillo is most likely to be using its den during midday and therefore this is the best time to use a fumigant or gas.

One fumigant that is easy to use, quite safe and effective is carbon disulfide. Carbon disulfide usually can be obtained at local farm-supply stores or possibly, the local drug store. This substance is best utilized by soaking a wad (softball-sized) of cotton or rags with carbon disulfide, and then placing the cotton or rags as far down the burrow as possible. Cover the den immediately with sod or heavy soil. Toxic fumes from this material will kill the armadillo (and sometimes, other animals) if it is inside the burrow. CAUTION: Do not use carbon disulfide near an open flame as it is a highly flammable material.

Carbon monoxide gas from internal combustion engines also can be used as a fumigant by attaching a hose to the exhaust, extending the other end of the hose as far into the burrow as possible, and closing off the entrance around the hole with compacted soil. Exhaust fumes should be expelled into the burrow for at least 20 minutes to kill the armadillo. This technique is not highly recommended since it also may result in a secondary poisoning hazard to other animals using the burrow.

Poison baits are not recommended; they are poorly accepted because of the armadillo's feeding habits and present another secondary poisoning hazard to other animals. One other method is frequently employed to control offending armadillos — and that is spotting them at night and shooting them. Make sure shooting is legal and safe in your area. The shot should be directed toward the animal's head, as these animals are difficult to kill otherwise. Remember that armadillo meat is edible if properly prepared and there is no bag limit or season on them.

If one of the above control methods is ineffective at discouraging or eliminating the offending armadillo(s), a combination of these will likely be more effective.

Scientist Defends Use of 2,4-D

The following is from a letter sent to the chairman of the Santa Cruz County board of supervisors about a hearing it held last October 30 on the possibility of banning use of 2,4-D. The board of supervisors voted to place a moratorium on the herbicide's use by the department of public works until additional information and testimony could be considered. Two more hearings were held, again with the same results. At the most recent hearing (December 11) the moratorium was continued until June at which time the county agricultural commissioner, county director of the extension service, and the department of public works have been asked to make recommendations on replacement herbicides and the "use of IPM in weed control." The writer is Dr. Kenneth Thimann who enjoys a worldwide reputation as a biologist, plant physiologist and bio-chemist. He is the possessor of a list of academic achievements and honors that is far too long to present here. The important thing insofar as this letter is concerned is that he is one of the world's true experts on the subject. — Editor

My name is Kenneth Thimann and I am professor emeritus of biology at the University of California-Santa Cruz. My speciality is plant biology and in particular the plant growth regulation substances (of which 2,4-D is one). I have written some 250 scientific papers and five books on this and related topics. I do not work for any firm that makes or sells 2,4-D (or indeed any other pesticide) and my sole interest in this matter concerns the truth.

2,4-D is the most generally useful of all herbicides. Its discovery arose from the work on natural plant hormones, to which it is related and not from the Army, as was claimed on Tuesday. This, by the way, was only one of some dozens of falsehoods to which I listened that evening. 2,4-D is the most generally useful herbicide because of three valuable properties: it is harmless to man, it is rapidly destroyed by bacteria in the soil (and to non-toxic breakdown products), and lastly it has the special ability to kill broadleaved plants (technically dicotyledons) without harming the narrow-leaved group (monocotyledons), a group that includes the grasses, wheat, barley, corn, rice, etc.

Thus it is most useful for killing weeds in corn or wheat; its use in Britain in the immediate post-war years is credited with causing a 30% increase in overall wheat yields. It has been in regular use throughout Europe and North America since about 1948; i.e. for 31 years, and in that time the only damage to humans ascribed to it, as far as I know, was to a few who deliberately drank it for suicidal purposes. Even then it has been hard to absorb a fatal dose.

It stands to reason, therefore, that the tiny amount one might take in from the spatter of a sprayer, etc., could not possibly exert a harmful effect. The man who claimed that, while working for the parks department he had sprayed some 2,4-D and the following day he "and all his team" had

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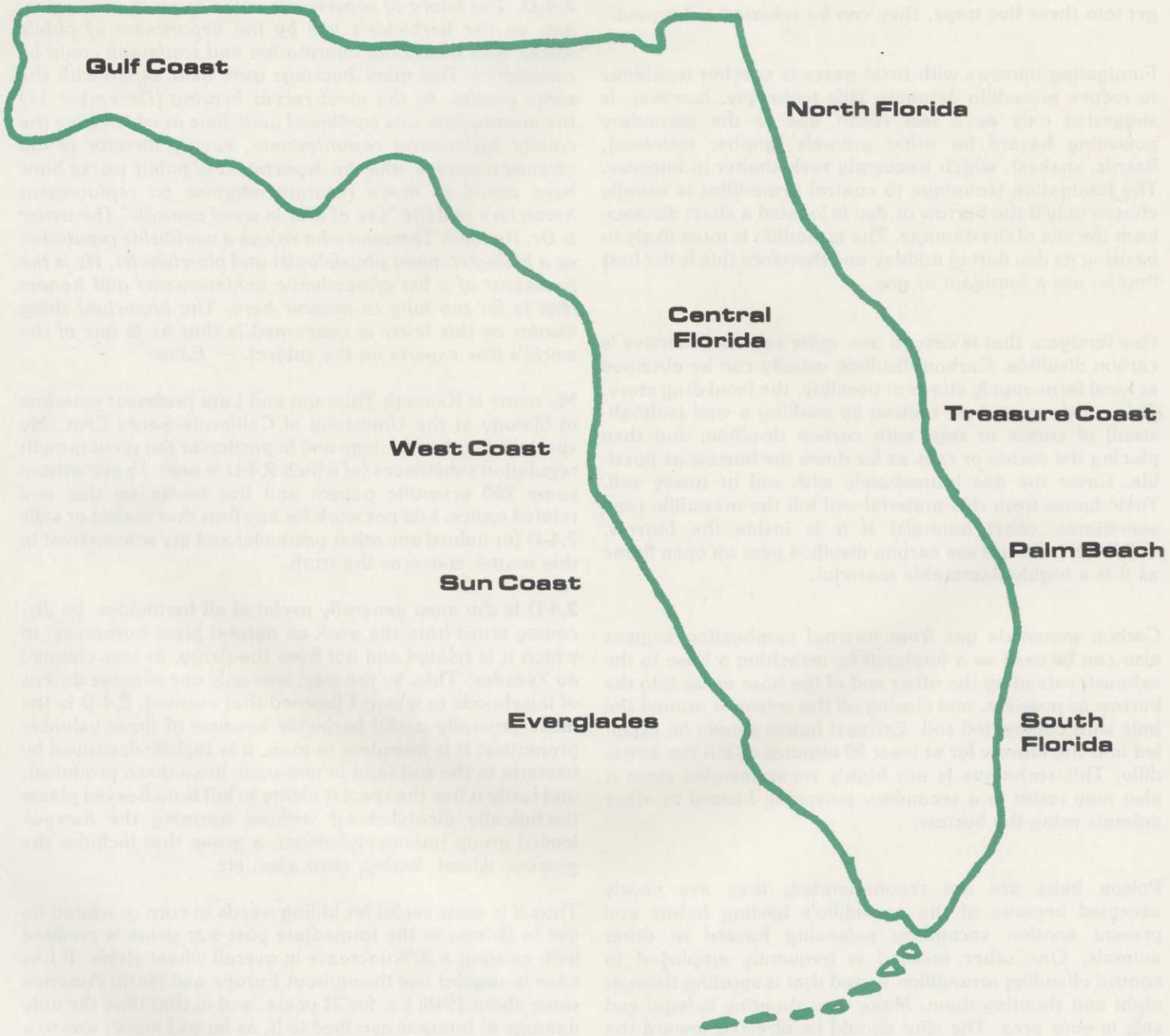

Every Florida Golf Course Superintendent Needs To Join The Golf Course Superintendent Association of America. Contact Your Local Chapter For More Information.

been sick, was therefore either (a) making up a story, or (b) mistaken as to the pesticide he was using. Even with 2,4,5-T (which is more complex because of the toxic dioxin present as impurity), the dose required for the minimum effect is excessively high.

In the often-quoted Bionetics Laboratory tests, the minimum dose of the impure 2,4,5-T needed to cause minimum birth defects in mice was 45 milligrams per kilogram, and was given daily for half the duration of pregnancy. Scaled up to a woman of 60 kilograms (132 pounds) she would have to eat nearly three grams of the solid *every day* for four and a half months. In normal spraying solution this would require drinking about half a gallon daily for that period. Since the substance tastes most disagreeable no one in his or her senses would drink even a glassful, let alone take it daily for 135 days. And 2,4-D, which is our present subject, does not contain dioxin anyway.

One trouble with many of the witnesses is that they were unable to distinguish between one compound and another. One said 2,4-D and 2,4,5-T are "about the same," thus completely missing the point about the toxin in the latter. Others declaimed against "pesticides" in general. Now some pesticides are indeed toxic to humans. When EPA made the mistake of banning the insecticide DDT, farmers and others resorted to malathion and other organophosphates which *are* toxic, and these have accounted for over 60% of the hospitalized cases of pesticide poisoning in 1976-77. (Almost 25% more were persons who took the insecticide intentionally!) Thus if the board makes the same mistake with regard to 2,4-D some more toxic herbicide may well come into use.

Many statements made at the hearing were incredible. The representative of Friends of the Earth claimed that 2,4-D was carcinogenic, mutagenic, caused birth defects and other illnesses, not a word of which was correct. Indeed, the only thing she did say that was true was that it killed the leaves of an apple tree (since it is an herbicide this would be expected). I pay the board the compliment of assuming that its members are interested in the facts and not in such hysteria . . .

Asulam in St. Augustinegrass

E. O. BURT and S. L. CARLYLE
Agricultural Research Center, Univ. of Florida
Rhodia Inc. Agricultural Division, Gainesville, Fla.

INTRODUCTION

St. Augustinegrass *(Tenotaphrum secundatum)* (Waltz.) Kuntze) is one of the most prevalent and economically important lawngrasses in tropical and semitropical areas of the world. In Florida, this grass comprises over 300,000 acres of turf including 46% of home lawns.

Atrazine has been used for almost two decades to control broadleaf weeds in St. Augustinegrass. However, grassy weeds are the most prevalent and difficult to control in this turfgrass. Currently, there are no practical means of post-emergent control of monocots by either chemical or mechanical means. Due to the long growing seasons, numerous applications of preemergent herbicides are required for nominal grassy weed control resulting in higher costs and sometimes injury to the turf, especially on lighter sandy soils.

Thirty-five experiments were conducted during 1975 and 1976 at the Agricultural Research Center at Ft. Lauderdale, Florida and other areas of the State to determine the effectiveness of asulam (Asulox®) for selective post-emergence control of established weeds in turf.

METHODS AND MATERIALS

Test areas included both clean and weedy turf sites, and mowed areas of weeds, alone. Varieties of St. Augustinegrass used in the testing included common, Floratine, Floratam, Bitter Blue and an experimental selection. Experiments were conducted during all seasons of the year to determine the effects of climate and photoperiod. Randomized complete block designs with 3 or more replications were utilized and plots varied in size from 1 to 3m in width and 6 to 83 meters in length. A soluble salt formulation of asulam containing 3.34 lb ai/gal was tested at rates of 1.00, 1.67, 2.00, 3.34, 4.00 and 6.68 lb ai/A delivered in 44-45 gallons per acre of water.

Asulam is a foliar absorbed, translocated herbicide. Applications were made without surfactants and surface irrigation was discontinued for at least 24 hours after application to allow for plant uptake.

Most plots were treated with single applications using a compressed air sprayer and fan jet nozzle tips mounted on a garden tractor unit. Combination treatments tested were applied as tank mixes with 2.00 lb ai/A of atrazine (80% WP) or 2.00 lb ai/A of MCPP (2.0 lb aiEC).

RESULTS AND DISCUSSION

Better than 80% control was achieved with asulam at 2.2 kg/ha on problem monocots including crabgrasses *(Digitaria* spp.), goosegrass *(Eleusina indica)*, bullgrass *(Paspalum supinum)*, and sandbur *Cenchrus incertus)*. In addition, significant suppression of bahiagrass (Paspalum notatum), common bermudagrass *(Cynodon dactylon)*, smutgrass *(Sporobolis poiretii)*, torpedograss *(Panicum Repens)* and crowfootgrass *(Dacyloctenium aegyptium)* was found at the 2.2 kg/ha rate with a single application. A 4.4 kg/ha rate gave 80% or better control of all the aforementioned grassy weeds growing in St. Augustinegrass turf. Control of weeds growing in turf was usually superior to that of weeds in a non-turf situation due to competition from the turf. Control of young and actively growing weeds was faster and more complete than with mature weeds. In addition, young weeds did not produce seed. Treatments made during winter months required 8-10 weeks for acceptable control while spring and summer treatments required about 4-6 weeeks.

Several species of broadleaf weeds were also selectively controlled by asulam at 2.2 kg/ha. These include creeping beggarweed *(Desmodium* spp.), Spanish needles *(Bidens bipinnata)*, mares tail or horseweed *(Erigeron canadensis)* and dog fennel *(Eupatorium capillifolium)*. The use of tank mixes of asulam plus atrazine of MCPP increased the spectrum of weed control without significantly increasing injury to the turf.

Injury to all varieties of St. Augustinegrass at the 2.2 kg/ha rate was negligible. A slight yellowing was noticeabe at about 3 weeks post-application but about 7 weeks post-treatment a more lush and intense color than in the untreated checks had occurred. At 4.4 kg/ha, yellowing was more noticeable at 3 weeks, but complete regreening again occurred and no actual injury to the turf was detected.

In general, turf which was maintained under healthy cultural practices including frequent mowing, irrigation and fertilization was less susceptible to herbicide injury, showed quicker recovery and accelerated weed kill by the herbicide.

Areas needing additional research include the effects of mulitple and split-applications, timing intervals for multiple applications, and combinations of asulam and other herbicides.

SUMMARY

Results from 35 experiments demonstrated the potential of asulam for the selective control of several species of monocotyledonous and dicotyledonous weeds in St. Augustinegrass. Susceptible weed species included crabgrasses, sandbur, paspalums, goosegrass, creeping beggarweed, Spanish needles and dog fennel.

Questions & Answers About Asulox®

Q. *What types of crabgrass are susceptible to Asulox® ?*

A. All varieties of crabgrass commonly found in Florida are susceptible to a single 4 to 5 pints per acre application of Asulox® .

Q. *What about using Asulox® on other bermudagrass varieties?*

A. Extensive testing has shown that common Bermuda, Tifgreen 328, and Tifdwarf varieties are susceptible to injury by Asulox® at the recommended rates for good weed control.

Ormond Bermuda is susceptible to Asulox® discoloration, particularly where accidental overlapping of spray occurs, and is therefore not recommended.

Q. *What rate of Asulox® should I use?*

A. Use 4 to 5 pints of Asulox® per acre.

Dilute Asulox® in 40-50 gallons of water per acre.

Don't cut the rate. You risk poor weed control..

Q. *When should I apply Asulox® ?*

A. Asulox® is a translocated herbicide which performs best when weeds are young and actively growing. Treatment of mature weeds (when seed heads have begun forming) will result in less than satisfactory control.

Asulox® is a foliar absorbed compound, and weeds should have sufficient exposed leaf surfaces when sprayed.

Q. *What about application equipment?*

A. It is essential that spray equipment be properly calibrated, and all spray nozzles on a boom be of uniform size and spray pattern.

Spraying in the early morning while dew is present will aid the operator in seeing where he has and has not sprayed.

Avoid overlapping. It is wasteful, and may cause undue turf injury.

Always turn off your sprayer when slowing, stopping or turning.

Q. *What about mowing?*

A. It is best not to mow turf for several days before treatment to insure good foliage on weeds for uptake of Asulox® .

Turf should not be mowed for at least 48 hours after Asulox® treatment to allow herbicide translocation into the plants.

Do not apply Asulox® to turf mowed less than 1″ in height as this turf is under stress, and can induce herbicide injury. (Do not treat tees or greens with Asulox® .)

Q. *What about irrigation?*

A. Do not irrigate turf for at least 8 hours after Asulox® treatment to allow for plant uptake.

Turf should be irrigated normally on subsequent days, and should not be subjected to moisture stress.

Q. *Is turf discoloration dangerous or unusual?*

A. Under certain conditions, a slight and temporary discoloration of the turfgrass may occur at 10-14 days after application. This is temporary, and does not adversly affect the turf.

Healthy turf is always less susceptible to herbicide injury. Turf under stress from lack of moisture, nutrients, disease, or insects should not be treated with herbicides.

Q. *Can I mix Asulox® with other chemicals?*

A. Do not mix Asulox® with other pesticides or fertilizers as these may inhibit its uptake or cause turf injury.

Do not use a surfacant with Asulox® as this reduces its selectivity and causes injury to the turfgrass.

Q. *How does Asulox® work?*

A. Don't expect overnight results since Asulox® is thoroughly translocated within the plant before it begins killing the entire plant.

Schedule of Asulox® action:

- Weeds cease growing and are no longer competing with turf
- Browning of weeds will become noticeable
- Susceptible weeds are nearly all brown
- Susceptible weeds are controlled

Guest Editorial

It was my opportunity at the recent Florida Turf Grass Association and Conference in Gainesville to present a check for $500.00 to the Scholarship and Research Fund of that association. The presentation was made in the name of the North Florida Golf Course Superintendent's Chapter. Our contribution, along with that of other chapters, clubs, businesses and the proceeds from the S & R Golf Tournament, totalled in the thousands of dollars.

Frequently, over the past years, the question of what we can do about EPA's systematic approach of removing our much needed chemicals from the market arises. Questions about how to afford fertilizing when the cost is so high, what we can do about the energy shortage and so on, have been and will continue to be discussed.

It appears to me that directing funds to scholarship and research hold the answer for us. With proper funding these people can find answers for us. Some of the problems that need to be addressed are: better mole cricket control, better grasses that need less fertilizer and less mowing, and better understanding of disease and other insect problems.

Many opportunities exist for channeling funds in this direction. At the recent conference one club contributed $450.00 by assessing itself .01¢ for each round of golf played in the last year. This in itself would not go far but it is an example for the rest of us. If 600 clubs did this it would amount to $270,000. Now that would do something!

It is time for us to quit waiting for someone to solve our problems for us. We have the mechanism for getting our problems solved if we can channel some much needed funds in that direction. Certainly discovery of better mole cricket control could save each of us thousands of dollars very quickly. The money for this research must come from those of us who stand to benefit directly from the discoveries.

Much discussion is needed on what should be a club's fair share but I think we should start in the $500.00 per year range per 18 hole course. That is not much money when you really think about what is at stake. In the long run it could make the difference between us continuing to be capable of providing golf quality turf or playing on cow pastures.

I challange each of you to give this some thought and discuss it with your management. If we can all come together on this we can control our destiny and we will not have to sit idly by and watch all of the tools we have to do our jobs with taken away from us with nothing to replace them.

Lewis C. Powell, Jr.
President
North Florida Chapter
Florida G.C.S.A.

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