

Thistle Down . . .

(Continued from Page 26)

just burning off the tops and leaving the healthy root systems to sprout again later, it gets all the way down into the roots and kills from the bottom up."

The Board was impressed, but also had heard about another post-emergence herbicide they wanted Bohnke to try—dicamba.

"We figured the Dacamine probably would do it by itself," Bohnke says, "but they asked us to try the dicamba, also, so we mixed the two on some parts of the field—at a rate of about a quart and a half of Dacamine and a half-pint of dicamba. A large part of the field was sprayed with Dacamine at about a quart to the acre, though, and it did every bit as good a job as the combination.

"Even though I knew Dacamine works slowly, the first time we sprayed this field, boy was I sick!" Bohnke exclaims. "I came back in here two weeks after we had gone over the field and the thistles were coming up thicker than hair on a dog!

"I figured we'd come back again in three weeks and spray again," Bohnke goes on. "When we got back, I couldn't believe my eyes—they were all just about gone! We sprayed it with another quart to the acre, anyway, just to make sure. That shot really got them down, and by the time we went in the third and last time I don't think we had a 10% thistle crop in here anymore. The grass was in beautiful shape, filling in where the thistles were dying out."

The weather at the time of the control job was far from ideal for weed control, although it was perfect for growing thistles. "We might have gotten them with a little less material and fewer applications if we hadn't had so much wet, cool weather," Bohnke admits.

The first application was made during the second week of July. The second shot of Dacamine went on three weeks later, and the last one was applied just before the football season started in September.

The School Board certainly had no complaints about the results. You've got to go over the field with a magnifying glass to find a thistle seedling anywhere. "If we see a new one peek up anywhere now," Bohnke says, "we give the boys a little Dacamine in a hand sprayer and let them give it a shot. With that kind of continuous control, we don't expect to have any thistle problems in 'Thistle Downs' any more."



After two games, six-month-old turf is in excellent shape, even after a heavy chemical weed control program to rid it of a serious thistle problem. Bohnke, left, and Diamond Chemicals representative Steve Derrick look over the luxuriant grass.

New Golf Course Product Boosts Microbial Activity

American Bio-Turf, a bio-chemical solution which aids the biological control of microbial environment through stimulation of microbial activity, has been introduced as an aid to golf course maintenance by Farm Builders, a division of American Bio-Culture, Inc.

Jack Grover, president of Farm Builders, announced that the opening of the American Bio-Turf division brings to the golf course superintendent the experience gained through more than ten years of research and development, pioneering the practical application of soil microbiology to everyday agriculture.

American Bio-Turf's stimulation of the soil microbes results in better water retention and penetration. Microbial activity also makes more efficient use of fertilizers applied to and turf.

The aerifying action of the microbes in the soil also minimizes the need for mechanical aerification of turn areas, thereby creating another budget savings for the golf course superintendent. For more details, circle (723) on the reply card.

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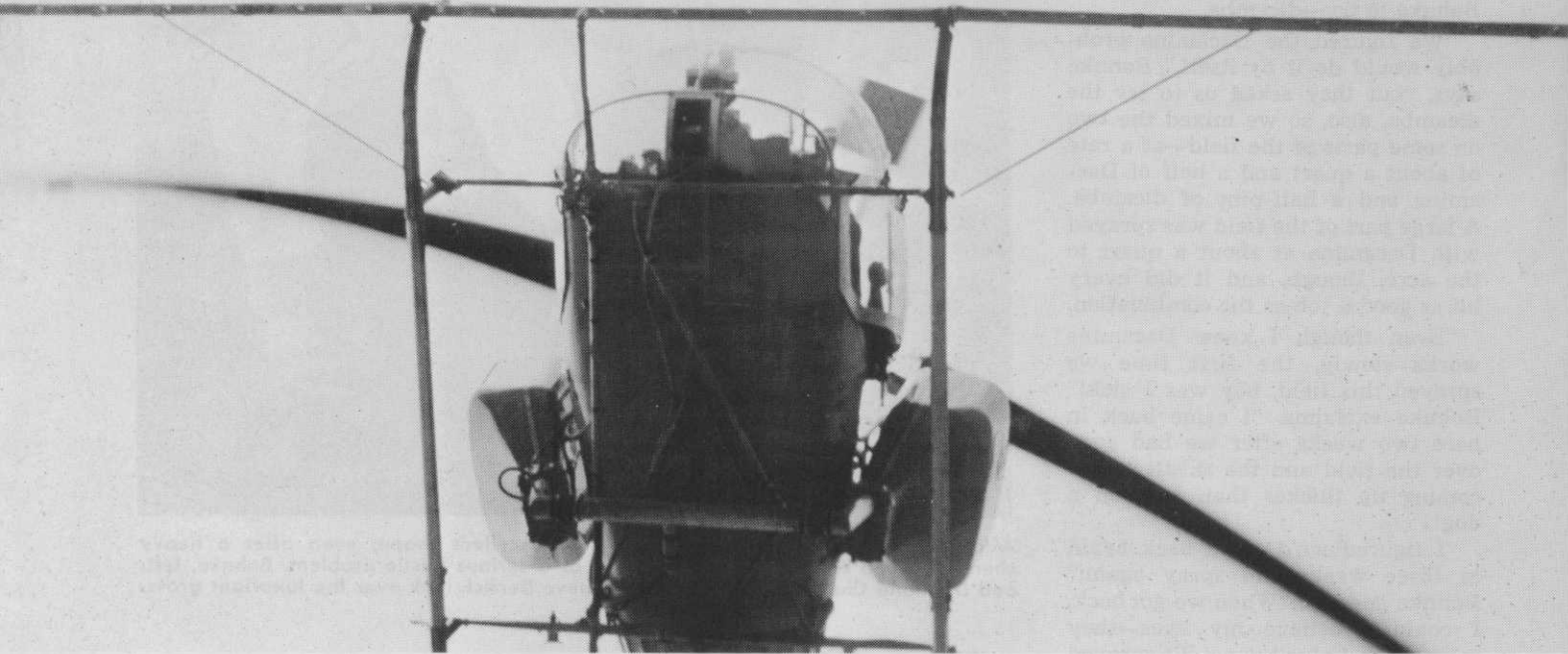
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RAPID-GRO

HELP FROM ABOVE

For the Golf Course Superintendent



A helicopter with a 25-ft. boom flying 30 mph sprayed the Indianapolis Motor Speedway Golf Course.

Special to WEEDS TREES and TURF
TUCO Division, Upjohn Co.
Kalamazoo, Mich.

INCREASING play on golf courses means increasing headaches for golf course superintendents. Maintaining high standards of turf quality and course playability within the limitations of a budget isn't easy, as all of us know.

Faced with a limited amount of money, a limited labor force and a limited amount of time for maintenance, cutting corners on turf disease control can become a temptation. However, short-changing your disease-control program is bad economics.

When you invest upward of \$50,000 a year in fertilizer, weed control, water and management practices—such as verticutting, aerifying, mowing and the labor they involve—your investment deserves the protection of a complete disease control program.

Many superintendents have discovered that fairway disease control programs actually pay their own way . . . by keeping golfers happier and by eliminating the

problems and costs which arise when fairway turf is lost.

The same basic principles and practices used to control disease on the greens apply to tees and fairways, although the degree of control required on fairways is not as critical as that required on greens. Disease control on the entire course should be integrated . . . and an integral part of your overall management program.

Helicopter Use Study

One promising new tool for economical fairway disease control is the helicopter. The same maneuverability and speed that make it an effective military weapon also make it an effective weapon in the fight against turf disease.

Many golf course superintendents have had the opportunity to observe applications of fungicide to fairways by helicopter in recent years. However, they have been skeptical about the precision of such applications, asking themselves: "Is it good enough to get the job done?"

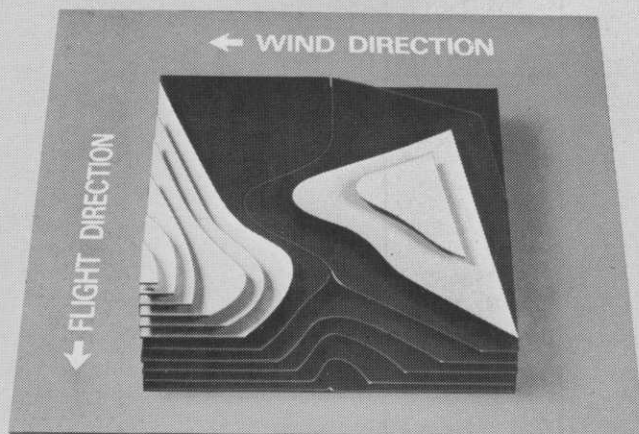
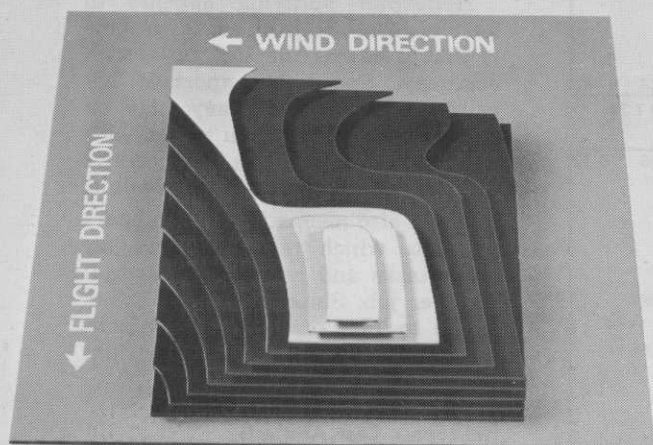
That question has now been answered in the affirmative. Results

of a three-year study conducted by TUCO, Division of The Upjohn Company, show that helicopter applications of fungicides can be made successfully at selected specific dosages. The studies have demonstrated that spray pattern distribution and droplet size are quite satisfactory for adequate coverage, and that the fungicide actually deposited falls within the required levels for the desired biological effect.

TUCO became interested in helicopter applications as part of its continuing research into fungicides for control of fairway turf diseases. Two years of biological studies were successful and most encouraging, but left this question unanswered: "Is it possible for a helicopter to spread an active amount of ingredient on the fairway when applying only five gallons to the acre?"

Indianapolis Golf Course Test

To find out, a test was conducted last year at the Indianapolis Motor Speedway Golf Course. Dr. Kent M. Beckman, TUCO's manager of fungicide research and one of the men



In level flight, the helicopter lays the spray down smoothly. Notice how the spray actually curls up and back, then settles in a relatively even distribution pattern, as shown on the three-dimensional model. Layers of the model represent gradations in application density. Light areas represent gradations above the calculated application rate, dark areas gradations below.

In non-level flight with a gentle cross wind, the characteristic tip whirl causes the spray to pile up at the periphery of the swath. The resulting unevenness in application density is shown by the three-dimensional model. Even under these conditions, the deposit of fungicide is sufficient for biological control.

involved in the test, explains it as follows:

"We laid out four test blocks along a fairway, each block 50 feet wide and 100 feet long. Inside the blocks we placed sheets of Whitman No. 1 filter paper, held in position on the turf with nails. The function of the filter paper was to intercept the spray as it was applied by the helicopter, so that we could find out the amount of material that actually would have been deposited on a specific area of turf.

"There were 10 such sheets strategically placed within each of the four blocks for each of two chemicals tested. This gave us 40 individual sampling sites per chemical, or a total of 80 samples.

"Both TUCO chemicals tested—Acti-dione RZ and Acti-dione Ferrated—are already in use by golf courses across the country.

"The helicopter began its run at the far end of the fairway and crossed over all four of the sampling

blocks. During the test, a cross wind was coming in at about 90° to the fairway and the flight path of the helicopter, but the pilot was able to stay low over the turf.

"The boom spread of the helicopter was 25 feet, and the pilot normally flew at an altitude that would allow coverage of a 50-foot swath on each pass. The width of the swath, of course, may be altered somewhat by changing the altitude at which the helicopter is flown.

"At the tips of the boom, the spray pattern swirled like the tail feathers on a Mallard duck. This action actually helped provide a throbbing-like motion on the turf, resulting in improved and complete coverage with the chemical.

"Following the spraying, each filter paper sample was placed in an individual plastic bag to prevent cross-contamination. The bags were taken to the TUCO plant health research laboratory at Kalamazoo,

Michigan. In the lab, each sample was extracted individually and the extract assayed."

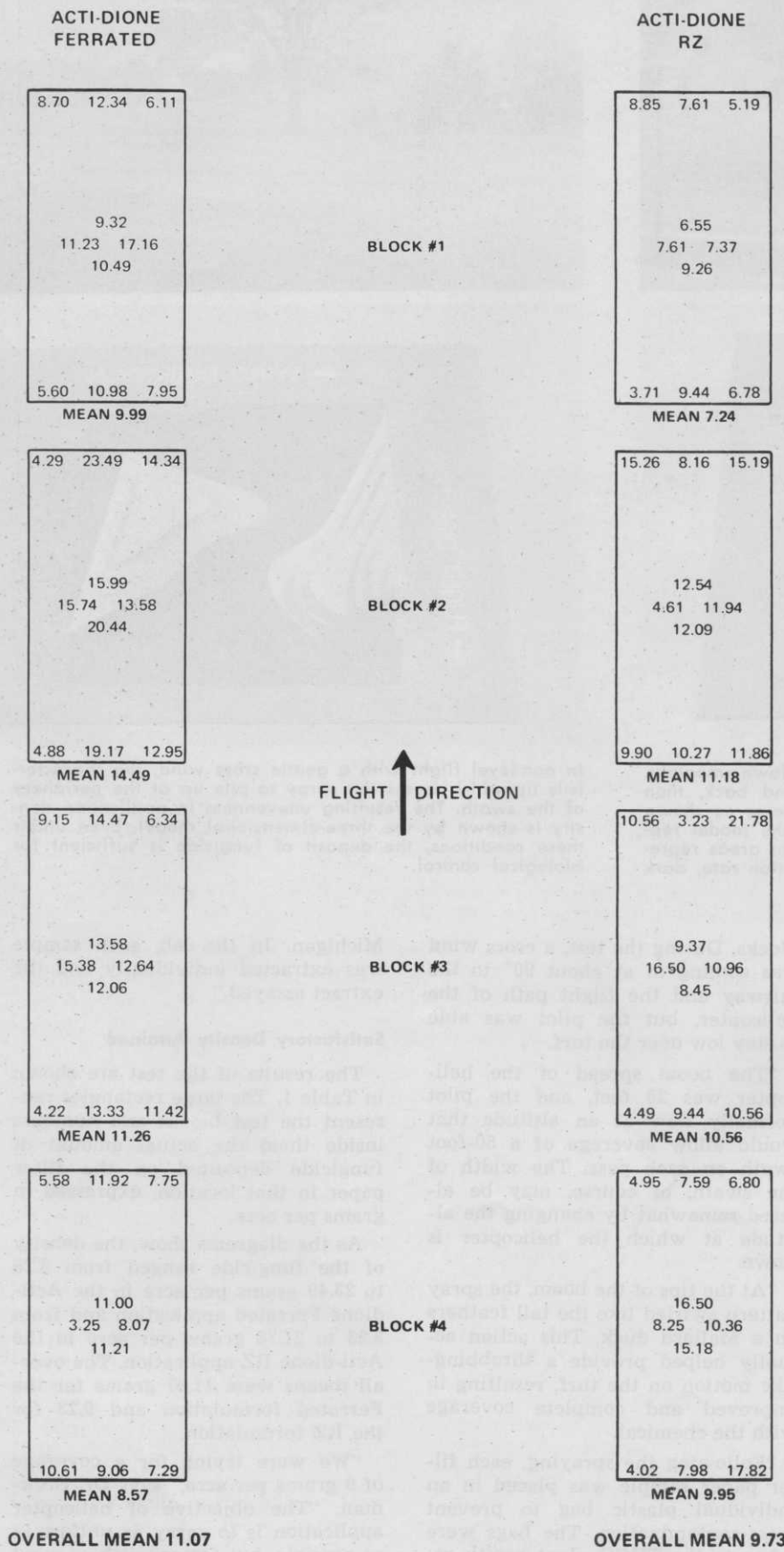
Satisfactory Density Attained

The results of the test are shown in Table 1. The large rectangles represent the test blocks and numbers inside them the actual amount of fungicide deposited on the filter paper in that location, expressed in grams per acre.

As the diagrams show, the density of the fungicide ranged from 3.25 to 23.49 grams per acre in the Acti-dione Ferrated application and from 3.23 to 21.78 grams per acre in the Acti-dione RZ application. The overall means were 11.07 grams for the Ferrated formulation and 9.73 for the RZ formulation.

"We were trying for a coverage of 9 grams per acre," says Dr. Beckman. "The objective of helicopter application is to spray as uniformly as possible, but factors such as wind velocity and direction, the flight

TABLE 1. Fungicide Coverage



attitude and altitude of the helicopter in relation to the turf, and the functioning of the spray system itself can cause some variation.

“All things considered, our studies indicate that the helicopter can deliver a satisfactory density of fungicide, and that when variations occur, they are usually in the positive direction. By that I mean that an excess of fungicide is deposited on the turf. In the case of Acti-dione products, that is not a cause for worry. However, fungicides with a narrower phytotoxic tolerance level could be detrimental to the turf and cause plant injury.”

Helicopter spraying appears to have several things in its favor. One is that it covers the turf fast—with accuracy. Speed is important because, with today’s heavy play on most courses from dawn to dusk, it’s important to have the work crews off the fairways as soon as possible.

Speed also means fewer man hours per job, which releases crews for other tasks and reduces the overall cost per job. Since labor costs make up 70 to 75% of most superintendents’ budgets, this is an important consideration.

Helicopter Cost Analysis

What does it cost to use a helicopter for fairway spraying? Nobody’s sure yet. More precise figures will be available after additional evaluations by TUCO this year. However, comparisons between ground spraying and helicopter spraying in citrus groves (see table below) show a definite cost advantage for the chopper. The economics on the turf should be equally favorable or even more so.

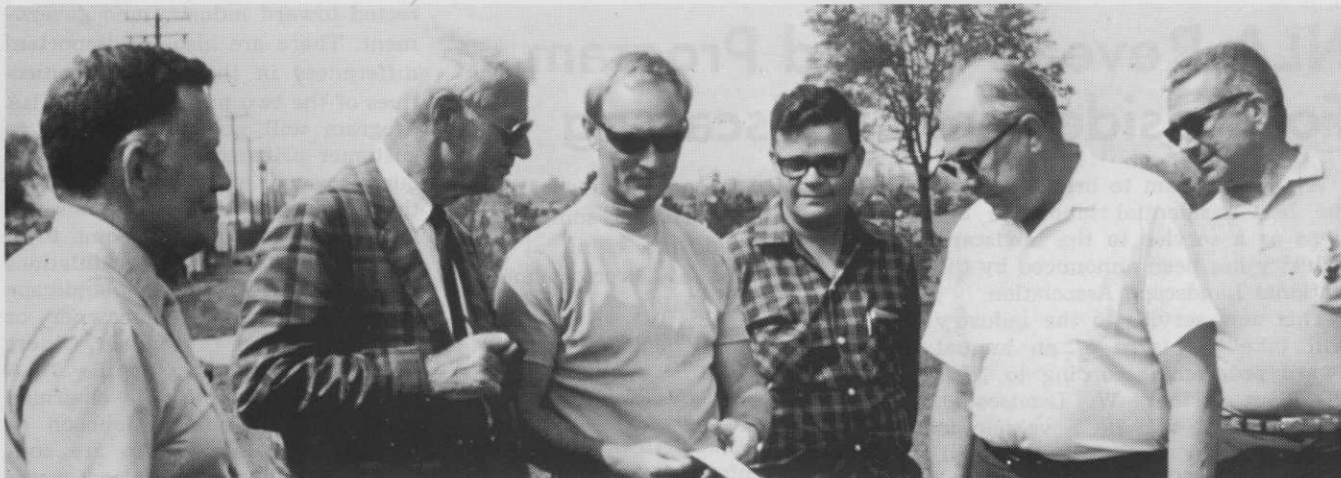
Annual per acre comparative costs of helicopters vs. ground spray in citrus industry are shown in Table 2.

One of the nice things about helicopter spraying is that you can generally put down right next to the water supply where you plan to work without damaging the turf. The skis distribute the weight of the chopper over a large area of turf, so the compaction is less than that from a golf cart.

Dr. Beckman has this advice about mixing spray solutions: “It’s always a good practice to pre-mix any wettable powder formulation before putting the material into the spray tank. Pre-mixing keeps the material from balling up and settling to the bottom of the tank.”

Wind Factor

As in any spraying operation, the wind needs to be considered when



Observers viewing a check tape showing spray distribution are, from the left: Joseph Kelly, Riley Lawn and Golf Equipment; Walter Hiser, Woodstock Club; George Lynn, Woodstock Club; James Joines, Mesingomesia Country Club; Marvin Scobbee, Highland Golf and Country Club; and Willard Thomas, Indianapolis Motor Speedway Golf Course.

The picture below shows the spray pattern obtained with helicopter application of Acti-dione Ferrated fungicide. The top panel is from the center of the spray swath. The bottom panel, from the edge of the spray swath, shows how the pattern thins out at the extreme periphery.

applying fungicide with a helicopter. A cross wind can carry the spray off target, and when the wind approaches 10 miles per hour it can affect the throbbing action of helicopter spraying when the pilot banks for a turn.

It is difficult to estimate wind velocity by visual observation, since, except for low altitudes, a surface wind is almost certain to be different from the wind at flight altitudes above the tree tops. However, for helicopter work, Table 3 should be of help:

Dr. Beckman's observations indicate that the use of a helicopter for applying fungicides to fairways can reduce labor costs without reducing the effectiveness of your disease-control program. It makes good business sense to consider this new tool in your overall management program for maintaining fine turf throughout the playing season.

Weed Science Career Pamphlet is Available

An eight-page pamphlet, entitled "Careers in Weed Science," is available from Dr. W. F. Slife, Weed Science Society of America Business Manager, Department of Agronomy, University of Illinois, Urbana, Ill. 61801.

A single copy will be sent free to anyone requesting it. Teachers, counselors, and industry representatives may request — on their letterheads — up to three free copies.

Quantity prices are: Six copies for \$1; 25 copies for \$3.50; 50 copies for \$5.50, and 100 copies for \$10.

Make checks payable to Weed Science Society of America.

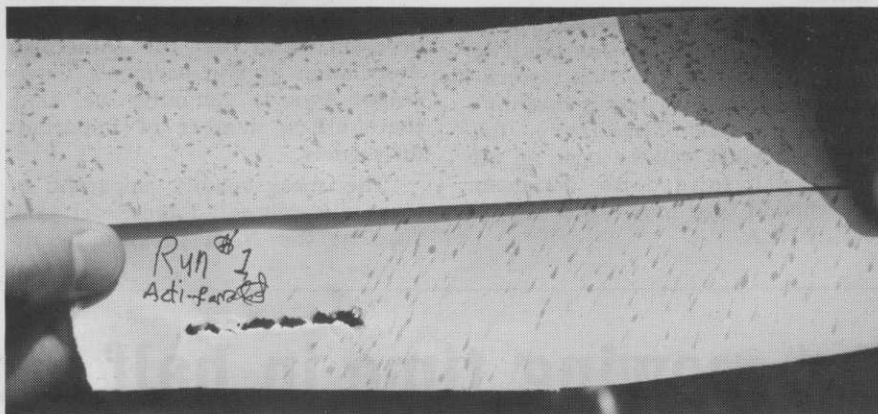


Table 2. Annual per-acre comparative application costs of helicopter vs. ground spray in citrus industry

Season	Helicopter	Ground Spray
1960-61	\$ 26.03	\$ 44.46
61-62	23.31	57.24
62-63	23.84	49.15
63-64	28.11	56.36
64-65	45.92	75.68
65-66	38.23	70.68
66-67	32.50	70.68
Total	\$217.94	\$426.42

Table 3. Helicopter Fairway Wind Scale

Wind Velocity	Terms Used in U.S. Weather Forecast	Land Signs
Less than 1 mph	Light	Calm; smoke rises vertically
1-3 mph	Light	Direction of wind shown by smoke drift, but not by wind vane
4-7 mph	Light	Wind felt on face; leaves rustle; ordinary vane moved by wind
8-12 mph	Gentle	Leaves and small twigs in constant motion; wind extends light flag
13-18 mph	Moderate	Dust and loose paper raised; small branches are moved.

NLA Reveals Award Program For Residential Landscaping

A new program to bring together the best residential landscape designs as a service to the landscape industry has been announced by the National Landscape Association.

This new service to the industry will take the form of an annual award program, according to NLA President Arthur W. Landseadel. The program will be a vehicle to bring together the best residential, apartment and condominium designs of the year for distribution to NLA members and other landscape professionals who participate in the program. Awards will be presented at the annual NLA Convention.

As the national association representing the landscaping industry, the NLA intends to give the award-winning designs as much distribution as possible. Therefore, the award program will be open to all professional landscape designers even though they may not be members of NLA.

This new program has been on the drawing boards for some time, and was voted into being at the January Board of Directors meeting, Landseadel said.

"The obvious purpose of this new NLA program will be to stimulate creativity of landscape designers, as well as to keep all of us abreast of what is being done in this field, and to give us information and new designs, allowing the designer to be aware of new developments and trends in residential designing," said the NLA President.

According to Landseadel this new award program does not compete with any existing national award program such as the American Association of Nurserymen's Landscape Award. Actually, he said, there are a number of important differences.

"The most readily apparent of these differences," Landseadel said, "is that the AAN program is di-

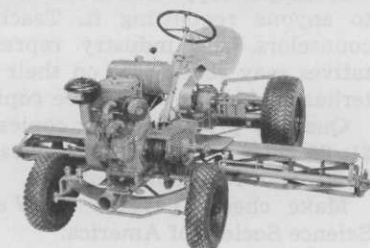
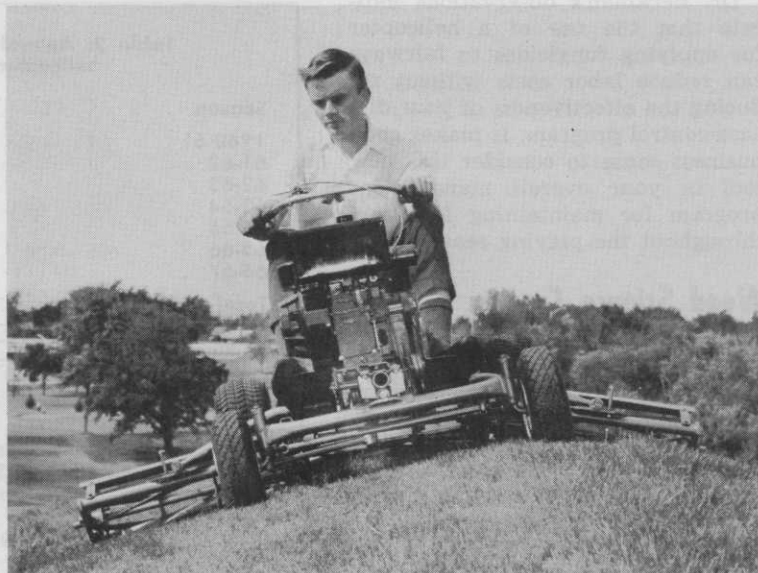
rected toward industry and government. There are also the important differences in the publicity objectives of the two programs. The NLA program will not be consumer or customer oriented. The publicity in our program will be restricted to the industry trade publications, releases to the recipients' home town press and letters of congratulations from the NLA to the landscape designer's clients (homeowner or property owner). Further, there will be no attempt in the NLA program to establish a chairman such as Mrs. Lyndon Johnson or Mrs. Richard Nixon. We are convinced that our financial resources for this program should be used to make available to the landscape industry the best in contemporary designs rather than giving widespread consumer publicity to the value of good designing and landscaping."

Landseadel concluded by saying that details of the new NLA Residential Design Award Program will be soon announced and entry information sent to the industry. Judging will be in the fall and awards will be presented at the reorganized NLA Convention, he said.

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FMC Corporation's Niagara Chemical Division has appointed two product managers to handle commercial development of a number of its proprietary pesticides at its Middleport, N.Y., headquarters. Howard Shmerler will be responsible for market development of Furadan insecticide for corn, rice and other products. Dr. Fred Kuss assumes responsibility for Tandex soil sterilant, Polyram fungicide, and ethion insecticide.

Edward M. Schoeck has been promoted to manager of the turf and garden department of U.S. Steel's Agri-Chemicals Division. He will be responsible for marketing and product planning for fertilizers and pesticides of the company's brand names of Vertagreen and Vertagard.

Tom Dlugos has been appointed agricultural chemical sales representative at Velsicol Chemical Corporation for northern Indiana.

Vernon J. Worrel of St. Paul has been appointed a vice-president of Ryan Equipment Co. Worrell, formerly chief engineer, will continue to manage the company's engineering functions as well as assuming responsibility for the company's manufacturing operations.

John C. Tapas has been elected vice-president of research and development for Velsicol Chemical Corp.

Connecticut Tree Protective Association has elected these officers: President, Thomas Williams; vice-president, Martin J. Kelly, Jr.; secretary, Oscar P. Stone; treasurer, Bernard Wright; editor, Philip L. Rusden; and directors, Martin Learned, Kenneth Grimm, Baylis Earle and John Stashenko.

Toro Manufacturing Corporation has announced the election of three vice-presidents. Roy T. Baril is vice-president and controller; Vernon A. Johnson, vice-president, secretary and general counsel; and Robert Quinlan, vice-president and corporate development.

Landscape Contractors Association of Metropolitan Washington has elected these officers: President, Morris C. Zuckerman of Arbor Landscapers; president-elect, Lew Block of J. H. Burton & Sons; vice-president, Robert Elder of Thomas E. Carroll & Sons; secretary, Harry Charles of Stoneybrook Landscape Co.; treasurer, Peter Driscoll of Arbor Landscapers; and directors, Ray Gustin II of Gaithersburg, Md., John Stock of Rockville, Md., William J. Mathews of Lorton, Va., Lewis Bassman of Rockville, James Haines of Hyattsville, Md., Charles Bowers of Silver Spring, Md., Rodney H. Witman of Towson, Md., John C. Lowry of Phoenix, Md., and Roger Carroll of Silver Spring.

Nels E. Sylvander has been appointed an operating group vice-president of Pennwalt Corporation in charge of the company's W&T chemicals and equipment unit. Sylvander joined Pennwalt with the merger last year of Wallace & Tiernan.

William G. Macksam, associate professor of horticulture at Colorado State University, has been named Colorado Golf Executive of the Year.

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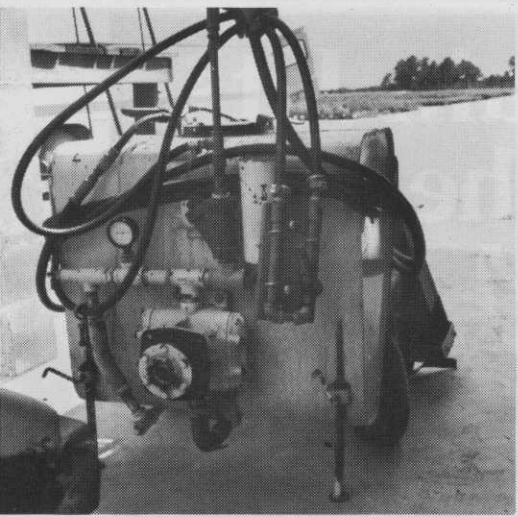
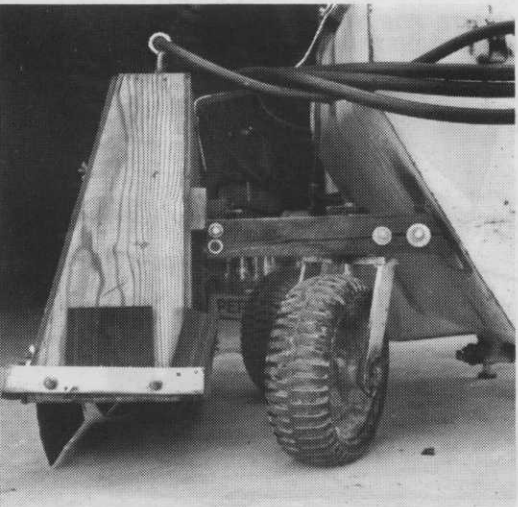
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It Saves \$2,000 a Year, He Says

Bill Colburn's Weed Machine



By BILL GENTRY
Orlando, Fla.



BILL COLBURN, president Cypress Creek Nursery, Inc., keeps his nursery aisles and roadways free of weeds for less than \$50 an acre and saves an estimated \$2,000 a year on labor costs by using a machine he designed.

One application of a mixture of simazine and paraquat will last three to four months and the operator can treat aisles in one acre in four hours.

The rig is a Gravely tractor with 20-gallon tank and a wooden hood built over a 30-inch boom with two nozzles which is attached to the front of the tank. Controls are on the handle of the tractor.

The hood is triangular-shaped and has metal bumpers on the bottom that curve inward and that help the rig to slide by nursery cans. The bumper is kept next to the cans as the machine goes down the aisles.

The two nozzles under the hood are adjustable up or down to increase or decrease the width of the spray. If just one nozzle is used it will cover a 15-inch-plus swath.

This saves spray if the operator wants to cover an area right next to cans without spraying the middle.

There are two control valves. One goes to the boom and the other goes to a handgun with a 30-foot hose with a trigger nozzle. This is handy to spray around trees in the nursery and places where the tractor

can't go, such as in holes left by large palms that were sold.

The triangular-shaped hood was designed to fit the nozzles and to go under overhanging plant branches. It's easy to reach the nozzles by removing several wing nuts that hold the cover in place. Nozzles are Tee Jet 8003.

"We put on two more filters in addition to the one on the spray tank to filter materials before they reach the nozzles. We put a "Y" filter past the pump and another filter in each nozzle," Colburn said.

He explained this was important because the low volume spraying made it difficult to tell if the nozzles were stopped up or not.

"It also saves a lot of nozzle cleaning," he added. "The operator used to carry a wrench because he had to clean nozzles so often."

Colburn says the spray will not drift, and he took rubber skirts off the hood when he found they were unnecessary. "We spray in 10-15 mph winds and I've never seen a bit of damage."

The bottom of the hood is three inches off the ground. Although it's adjustable, Colburn keeps it at three inches as this is the best height in his nursery.

Generally it takes an hour to put out the 20-gallon tank over a quarter acre of aisles. The machine is run in low gear unless a heavy patch of weeds is encountered then it's run in low volume. This doubles the volume of weed killer.

"If we had weeds that were easy to kill, we'd run it in high," Colburn said. Spurge is one of the main weeds in the nursery, located on a former citrus grove.

A control valve on the handle allows the operator to cut the nozzles off when the machine is turning around. This saves valuable spray.

The nurseryman said he experi-

The top picture shows how Colburn's homemade weed rig is attached to a 20-gallon tank. In the rear view, note the Y-shaped filter attachment and the U-shaped controls that are placed on the handle from a Gravely tractor. The inside view shows the twin nozzles. Note the trigger nozzle lying in front. It's used with a 30-ft. extension. The hood is held in place with five wing nuts and is easily removed.



Weed-free aisles last three to four months at Cypress Creek Nursery, reports Colburn. Note the controls near the left hand. Metal bumpers at the bottom of the rig permit spraying to the edge of the cans.

mented with 8-10 chemicals for about a year and with various proportions before arriving at his present mixture, which he said turned out to be one of the least expensive.

He uses 16 ounces of paraquat, 16 ounces of simazine wettable powder and two ounces of X-77 spreader sticker, mixed in the 20-gallon tank. This mixture costs \$48 an acre.

Colburn specifically stayed away from types of weed killers that would sterilize the soil and cause harm to roots protruding from the bottom of cans.

The machine is also used in roadways and in grassy patches of land being cleared for nursery plantings. Colburn estimates parts and wood used to build the rig cost \$50-60.

Almost all the nursery stock is canned materials set on four mil black poly plastic which holds down the weed population. Potting soil is steamed.

William Colburn is president of the Florida Turf Grass Association, a former golf course superintendent at Bay Hill Country Club, a former assistant county agent and is a registered landscape architect.

Certified Nurseryman Program Under Way in California

More than 100 candidates have taken the examination to qualify as "California Certified Nurseryman," according to Norman A. Springer, chairman of the Nurserymen's Certification Board.

"Of those who passed the test, about half have completed the additional requirements and have been certified," Springer said. The board administers the program sponsored by the California Association of Nurserymen.

Three years of planning went into CAN's certification program. It was

launched this January.

To qualify for certification, candidates must have had at least one year's work experience in a CAN-member retail nursery. There is a \$25 testing fee, and certification must be renewed every three years. A \$15 renewal fee is involved.

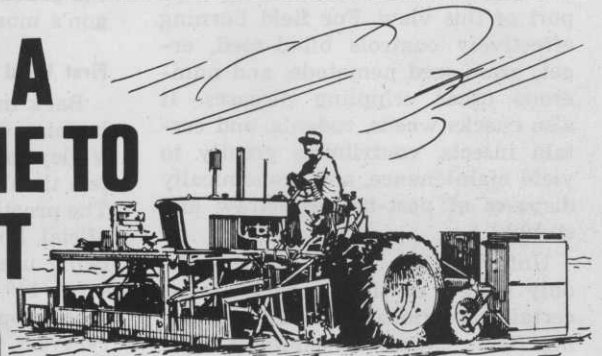
A Nurserymen's Training Manual was published, and serves as the study text for an examination. Copies of the manual are available through the CAN office, Suite 303, 1005 8th St., Sacramento 95814. Cost to CAN members is \$5; \$7.50

to non-members.

The next scheduled certification examination is set for the morning of June 9, prior to the opening of the Nurserymen's Refresher Course at Cal Poly, San Luis Obispo. Advance registration for the examination is required, and the \$25 testing fee must accompany the application.

The three-hour exam has a written portion based on the manual; a portion on use of plants in the landscape; and an identification test on 100 plants.

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EDITOR'S NOTE: The searing public issue in the Northwest of field burning hangs over the seed-production and sod-growing industries like a guillotine, ready to cleave off a major share of the profits of many growers or completely kill the business of countless others. The roar of air pollution from the cities causes rumbles constantly in the

State House. The question is whether the outcry will get results before researchers get answers. Research for economically feasible alternatives is frantic. Following is a condensation of field burning research from Oregon State University, as reported in the winter edition of the University's "Oregon's Agricultural Progress."

grains. And the volume of straw and stubble residues being burned was estimated to exceed 700,000 tons.

The field burning season generally lasts about two months, beginning around Aug. 1 and continuing through Sept. 30. Normally, this is a period of fine weather in the Willamette Valley. But it also is a period during which the airmass above the valley becomes increasingly stagnant and poorly ventilated. As summer progresses, therefore, the capacity of this airmass to accept, dilute, and disperse all of the emissions produced by burning is increasingly likely to be overpowered. When it is overpowered, of course, the result is greatly intensified levels of local air pollution.

In recognition of this increasingly serious problem, OSU scientists are conducting intensive research in many areas related to field burning. This effort, reports R. M. Alexander, assistant director of the Agricultural Experiment Station, is aimed both at finding ways to alleviate the harmful effects of field burning and at finding alternatives leading to reduced use or elimination of the practice. Among the significant general findings to date:

- The excellent field sanitation which burning provides is of prime importance for most perennial grass seed crops. As yet, no satisfactory alternative way has been found to control the major diseases of perennials.
- Burning of some perennial grass seed crops on an every-other-year basis may be possible without drastic yield reductions. In addition, two relatively smoke-free residue disposal devices now being developed — a propane flamer and a mobile incinerator — may prove capable of replacing at least a portion of the open burning in perennials. Both

FIELD GRASS SEED INDUSTRY TEETERS ON ISSUE OF BURNING

FIELD BURNING, a Linn County grass seed grower remarked recently, "is by far our industry's most essential cultural practice. Without it, grass seed production in the Willamette Valley simply wouldn't be feasible."

There is much evidence in support of this view. For field burning effectively controls blind-seed, ergot, grass seed nematode, and numerous other crippling diseases. It also checks weeds, rodents, and certain insects, contributes greatly to yield maintenance, and economically disposes of post-harvest straw and stubble.

Unfortunately, these are not the only effects of the practice. Under certain conditions, smoke from burning fields causes considerable visi-

bility loss and occasionally serious traffic tie-ups. Field burning also injects into the atmosphere gaseous pollutants and contaminant particles that often soil and otherwise damage personal property. And it may affect human health. As a result, use of the practice has become one of Oregon's more significant public issues.

First Used in 1940s

Back in the mid-1940s, when field burning was first used on Willamette Valley perennial grass seed fields, less than 50,000 acres were involved. The practice proved sufficiently beneficial, however, that by 1968, it was being used on an estimated 315,000 acres: 140,000 acres of perennial grass seed crops, 90,000 acres of annual ryegrass, and 85,000 acres of small

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