onsider when you plan

rrigation Systems

thletic Fields, Cemeteries, and Turf Nurseries

late the pump capacity (output) required in gallons per minute (GPM).

For Portable Systems:

$$GPM = \frac{453 \times I \times A}{H \times D}$$

Where I = Inches water to be applied
A = Acres to be covered
D = Days required to cover
H = Hours of operation per day
GPM = Pump capacity, in gallons per minute
453 = A constant

For Permanent Systems:

Precip. Rate Desired	GPM/Acre
0.15	67.5
0.20	90
0.25	112.5
0.30	135

Soil Holds Water

Before we begin to design an irrigation system, we must have certain information on soil moisture. We must know the available water-holding capacity of the soil in the root zone of the plant (inches of water per foot depth of soil). This helps determine the *amount of water to apply* each time you irrigate and the frequency or interval of irrigation. For example, assume that your soil type is Lakeland fine sand, which has a water capacity of 0.50 inch per foot depth, (Table 2), and your turfgrass has an effective root zone depth of 2 feet. Then, 0.5 inch/ft. depth × 2 ft. = 1.00 inch available water capacity. Then, ½ × 1.00 inch = 0.50 inch water to apply at each irrigation. However, since our irrigation efficiency in Florida is about 75%, we need to apply $\frac{0.50}{0.75}$ or about 0.65 inch per application.

Research has shown that the daily maximum consumption of water by certain grasses is about 0.25 inch per day. From June to August, then, our irrigation interval or frequency would be $\frac{0.65}{0.25}$, or about every 3 days. The frequency of irrigation is not a set figure but is based upon soil moisture and plant relations. There will be intervals 2 to 3 times as long between irrigations in winter months as in hot summer months.

Supplementary irrigation must be designed to have the capacity to apply the necessary depth of water to the area in a given time. Variation in the depth of water applied should not exceed 20%, to any part of the area, and any one part should not receive 15% more than other parts. Increasing the space between sprinklers is not a solution to an uneven coverage.

Losses in water pressure result from friction in mainlines, laterals, risers, and elevation changes. For a reasonably uniform distribution of water, pressure losses in lateral lines should not be more than 20% below the operating pressure. Total friction losses in both the mainlines and laterals should not exceed 25-30% of the operating pressure.

Many systems are sold in which 20 to 30 psi. pressure is lost in some mainlines. This happens when smaller sized pipe is used. Furthermore, even though a larger power unit may increase the pressure, the friction losses increase operating costs. In summation, ASAE standards should be strictly adhered to in allowable friction losses.

Sprinkler Spacings

Medium-pressure sprinkler nozzles should be spaced at intervals not greater than one-half the distance of their effective diameter if wind conditions are normal. Sprinklers spaced 70%

(Continued on page 38)

Table 2. Approximate available moisture capacity of some typical Florida soils.

Soil Type	In. Water per 1 ft. Depth	In. Water per 2 ft. Depth	Amount Water to Apply Each Irrig.*
Ridge Soils:			
Lakewood fine sand	0.35	0.70	0.47 inch
Blanton fine sand	0.40	0.80	0.52 inch
Lakeland fine sand	0.50	1.00	0.65 inch
Ft. Meade fine sand	0.70	1.40	0.93 inch
Orlando fine sand	0.80	1.60	1.05 inch
Flatwood Soils:			
Pomello fine sand	0.2	0.40	0.27 inch
Adamsville fine sand	0.5	1.00	0.67 inch
Pompano fine sand	0.6	1.20	0.80 inch
Immokalee fine sand	0.7	1.40	0.93 inch
Scranton fine sand	0.7	1.40	0.93 inch
Leon fine sand	0.8	1.60	1.05 inch

*includes evaporation losses, at 75% efficiency.

How WATER Affects Plant Life

By S. R. WEST
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Crops Research Division, Agricultural Research Service
U. S. Department of Agriculture, Florida Agricultural Experiment Station
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PLANT GROWTH and other biological systems are only possible because water possesses the most unusual combination of properties of any known liquid. Environmental extremes are tempered and reduced by these properties. Evaporation produces a strong cooling effect, and its condensation from vapor has a warming effect. It is a good conductor of heat, and thus water distributes heat received on a plant's surface rapidly throughout the plant itself. This conductivity also enables heat to be readily passed from inside the plant to its surfaces to help reduce damage during short periods of low temperatures.

The high density, high surface tension, and high tensile strength of water allow it to withstand the suction forces that pull it to the tops of plants. Water adheres firmly to plant surfaces, and its tendency to be absorbed explains why there are large amounts of water in cell walls and protoplasm; why they swell when they take in water.

Since it is a poor conductor of electricity, water is an excellent solvent for electrolytes, which can ionize freely. Another desirable property, of significance to green plants, is the high transparency of water that permits light and other forms of radiation to penetrate even thick leaves. But, because water is not transparent to infrared light, it traps heat inside the plant.

Uses Of Water In Plants

Because of its unique combination of properties, water is an essential factor to the very existence of life on earth. Water has the most unusual combination of functions of any substance found in plants. These functions can be listed under four general headings.

As a constituent. Water, an essential constituent of active protoplasm, often makes up 80-90% of the fresh weight of grass plants. A decrease in water content much below normal is accompanied by a decrease in rates of various physiological processes. If the water content falls below a certain critical value, death from dehydration occurs. A few plants can be dehydrated to air dryness without being killed, but most of our grasses do not fall into this category. Even when the water content is reduced to a low level by such treatment, physiological activity also is reduced to a low level. Water, therefore, is a very important constituent of protoplasm.

As a reagent in plant use. Various physiological processes in plants depend upon water as a reactant, including photosynthesis, the conversion of starch to sugar, and the breakdown of protein to amino acids. An important reagent in all of the ester formations that take place in plants, it is essential for many of the energy transfer reactions. Water can react with all kinds of compounds because of its unique chemical properties.

As a solvent. Water is perhaps the most universal solvent known. Even most gases are readily soluble in water. Thus, oxygen and carbon dioxide can readily pass from cell to cell within a plant. Vacuoles, or large central cavities in older cells filled with a water solution of many components, serve as a sump for toxins and other excess materials because of the great range of solubilities in water. Cells are joined together by water and permit transfer of soluble materials from one cell to another and from one organ to another. Many important substances such as sugars, organic acids, phosphates, and nitrates are soluble (if hydrogen bonding is possible) and therefore transferred.

For maintenance of turgor. Another role of water is to maintain turgor, essential to leaf form, new shoots, stems, and other plant structures. Water and turgor are essential to the opening of stomata (gas and vapor exchange pores) and movements of leaves, flower parts, and other plant structures controlled by changes in turgor. The most evident effect of an internal water shortage is a reduction in vegetative growth, because maintenance of a sufficiently high water content for a certain minimum turgor seems essential for cell enlargement.

Amount Of Water Used

Although plants actually use less than 5% of the water that passes through them, the total volume they take up appears to be necessary. The State Climatologist of the U. S. Weather Bureau of Gainesville, Florida, calculated that evapotranspiration of water from grass sod could be as high as 40 inches in a 12-month period. Thus, turf uses 3½ feet of water each year. Due to poor water-holding capacity of many Florida soils, poor distribution of rainfall, and too high use of water, deficits of water develop in our grasses, loss of turgidity occurs, numerous plant processes are impaired, growth is reduced or ceases, and death from desiccation finally results.

Survey Of The Problem

The best hope of relief would seem to be through the development or introduction of grasses that are better able to withstand the stress of drought. With this motivation, we have been attempting to locate and describe the metabolic processes in a grass plant that are affected by water stress. This information will provide plant breeders with specific selection criteria, so that their work can be greatly concentrated and a solution to the problem made more expeditious.

Research reported in the literature indicates that a variety of factors increase drought resistance. These include efficient root systems, thick cutin, and stomata that close promptly when water deficits develop. These characteristics serve to postpone the damage caused by drought; but the final test involves the ability of the living cell to endure critical water stress.

If we accept that cells are the fundamental units of which all living organisms are made, it may be assumed that the response of a plant to stress will be reflected by the effect of treatment on cellular processes. Cells grow as a result of the satisfactory completion of thousands of chemical reactions. Most of these reactions are mediated by enzymes which are made, to a large extent, from protein. Thus the expression of heredity or nuclear information must necessarily depend upon the proper synthesis of these proteins.

Proteins are giant molecules consisting of chains built from about 20 different kinds of amino acids or building blocks. Thousands of different proteins go into the makeup of one living cell. Those proteins perform thousands of different acts in the precise sequence that causes the cell to live. Each protein appears to be designed with high specificity for its particular task. The features of this design of proteins are the number and exact sequence of the amino acids that make up the large molecule.

The main task and function of genetic information is to provide that all of those proteins, that do the work of the cell, get synthesized in good order at the proper time. Genetic information of the cell which constitutes these instructions is embodied in another large molecule, deoxyribonucleic acid (DNA). DNA is largely confined to the nucleus and makes up a large portion of chromosomes. Protein synthesis takes place outside of the nucleus in the cytoplasm of the cell. Therefore, DNA does not take part directly in the aligning of amino acids to make proteins. Instead, the genetic code in the long double-chain molecule of DNA is transcribed into shorter single chains of ribonucleic acid (RNA) which carry away the information needed to construct one kind of protein. Because these molecules of RNA carry the genetic information, they are called messenger RNA (mRNA). Current dogma which is supported by data suggests that mRNA is made in the nucleus on DNA. The final joining of amino acids to make protein takes place on ribosomes which are found in the cytoplasm. These ribosome particles, visible only with the electron microscope, contain a large fraction of RNA.

Protein Synthesis Studied

In our search for the key to what the stress of lack of water may be doing to limit growth, we looked first at protein synthesis. We found that when water stress reduced protein by 40%, growth was reduced twice that amount or 80%. Contrary to what may have been expected, total RNA increased by 30% in the same water-stress treatment. More surprising still, the increase in RNA appeared in the ribosome fraction. This meant more machinery was present for making protein, yet less was made.

Subsequent tests revealed that the information from the nucleus was being drastically altered by the water stress. We do not yet know whether messenger RNA is still being made as a result of the drought conditions, or whether the message that is synthesized does not contain the correct information. At any rate, we have determined that water stress prevents mRNA from functioning in protein synthesis. We are now trying to determine the nature of the effect of drought on this very important fraction of RNA. Then we will be searching for plant materials whose mRNAs are not susceptible to water stress, or for ways of inducing resistance in our fabricated, drought-tolerant grass.

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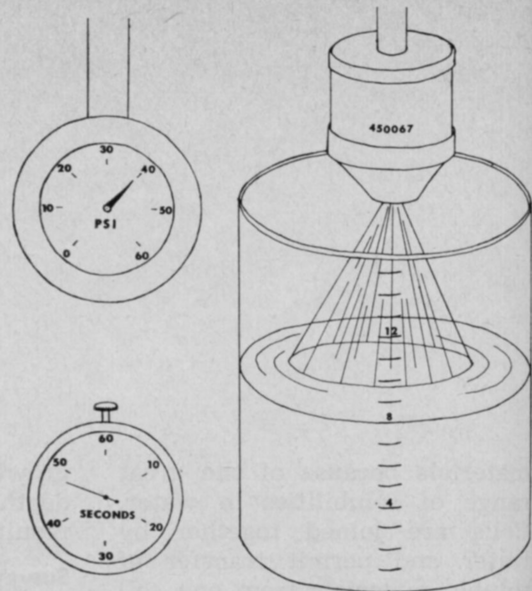
Are Worn Nozzles Stealing Your Spray Chemicals?



Worn and uncalibrated boom sprayer nozzles are important causes of wasted chemical on large-scale, blanket spray jobs. Holes in nozzles become larger from wear caused by impurities and abrasives in chemical sprays and water.

To determine the actual discharge of a spray nozzle, regulate the pump at 40 pounds per square inch (PSI), and catch the discharge of one nozzle in a measuring container for one minute. Use a container measured in ounces.

Check the number of the spray nozzle. Count three decimal places from the *left;* this will be the original discharge rate of the nozzle hole at 40 PSI. If, for example, the number is 8002, nozzle discharge should be 0.2 gallons per minute (GPM). If the number is 800067, the output from that nozzle should be .067 GPM.

Note the amount of liquid collected in the measuring container. When the nozzle output is supposed to be 0.2 GPM, 25.6 ounces should be collected. If .067 GPM is the nozzle-output rating, 8.5 ounces should be collected in one minute.

Ounces are converted to gallons by using the following formula:

$$\frac{128 \text{ oz.}}{1 \text{ gal.}} = \frac{\text{(Ounces collected in one min.)}}{\text{(Gallons discharged in one min., GPM)}}$$

If 8.5 oz. are collected, 8.5 replaces "(Ounces collected in one min.)" in the formula. To find "(Gallons discharged in one min., GPM)", cross-multiply.

$$\frac{128 \text{ oz.}}{1 \text{ gal.}} = \frac{8.5 \text{ oz.}}{\text{(Gallons discharged in one min., GPM)}}$$

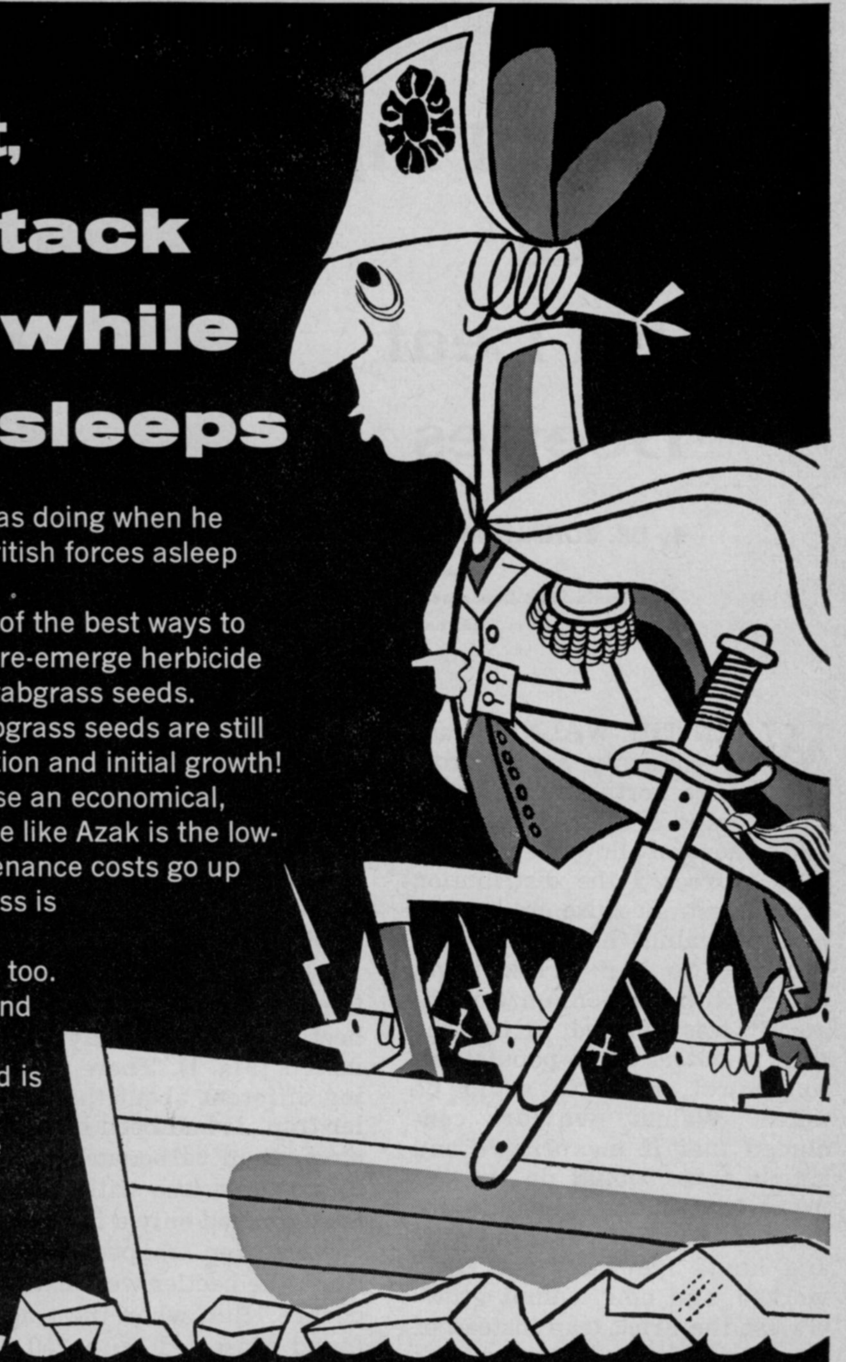
$$1 \text{ gal.} \times 8.5 \text{ oz.} = 128 \text{ oz.} \times \text{(GPM)}$$

To find GPM, multiply 1 gal. by 8.5 oz. to get 8.5. Now divide by 128 and the answer is .067, showing that the nozzle is giving out the rated number of gallons it was originally calibrated to put out. However, if the nozzle number rating is less, .055 GPM for example, then the actual output (8.5 oz. or .067 GPM) is too much, and chemical spray will be wasted.

A nozzle that discharges .067 GPM when it is expected to discharge only .055 GPM wastes more than ½ gallon of spray solution in one 8-hour day. Multiply this waste (½ gallon) by the number of worn nozzles on a spray rig, 12 for example, and a total of 6 gallons of spray would be wasted each day.

Increased discharge by worn nozzles can be remedied in two ways. Either replace worn nozzle parts, or reduce the number of nozzles on the spray boom so the total discharge from all nozzles will not exceed recommended dosage rates.

That's right, General, attack with AZAK® while the enemy sleeps



General Washington knew what he was doing when he crossed the Delaware to catch the British forces asleep at Trenton.

And, turf managers know that one of the best ways to get rid of crabgrass is to use Azak® pre-emerge herbicide before warm weather awakens the crabgrass seeds. Applied to established turf while crabgrass seeds are still asleep, Azak prevents seed germination and initial growth!

Turf managers also know that to use an economical, one-application, pre-emerge herbicide like Azak is the low-cost way to control crabgrass. Maintenance costs go up when control starts after the crabgrass is up and damaging good turf.

Azak has other important benefits, too. It is safe for most established lawn and other ornamental turfgrass at the recommended rate. It is odorless and is used as a wettable powder or as a granular product. Azak is compatible with other pesticides and fertilizers, thus can be applied alone or in mixes. It is low in toxicity to warm-blooded animals.

USING NITROFORM® CAN CUT COSTS, TOO

Turf managers also know that by using Nitroform, Hercules ureaform (38-0-0), they can put on enough nonburning, long-lasting turf food at one time to cut the number of fertilizer applications. Nitroform nitrogen is released slowly in contrast to low-analysis, quick-acting fertilizers. With fewer applications required, storage space is saved and maintenance crews are released for other work. These advantages keep overall maintenance costs down. Nitroform is odorless and resists leaching. Available in two forms: Blue Chip® for mechanical spreaders and Powder Blue*, the first ureaform for spray application.

HERCULES® TURF AND HORTICULTURAL PRODUCTS

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* HERCULES TRADEMARK

STH66-3

Simple Trap for Elm Leaf Beetles

By DR. RONALD M. HAWTHORNE

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California State Department of Agriculture
Sacramento, California

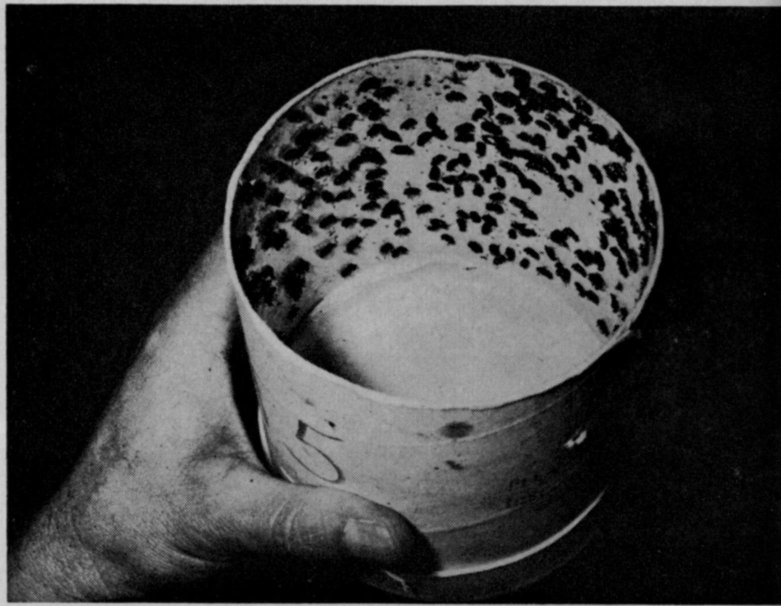


Fig. 1. Elm leaf beetles literally coated this Frick trap which was hung in an apple tree near an elm tree. Almost all of the insects in this trap were elm leaf beetles, more than 250 by actual count. The trap was baited with ammonium carbonate.

WHEN THE WALNUT husk fly suddenly moved from southern to northern California, Frick traps (Fig. 2) picked up adult flies and allowed entomologists to record the distribution of this pest. Because great numbers of walnut husk flies were attracted to the Frick traps, baited with ammonium carbonate, it was decided to use the trap to detect early populations so control measures could be taken. Walnut growers concluded that if inexpensive and simple traps would do the job properly, the traps would eliminate the necessity of using pans and liquid lye bait. The traps worked, and now walnut growers use the Frick trap instead of lye pans to detect incoming husk flies.

When the "all-purpose" Frick traps were removed from California cotton fields, where they were being tested for pink bollworm detection, they were placed in fields nearby and checked by County Agriculture Departments. Many interesting insects were found in them.

Elm Leaf Beetles Plaster Trap

One rather outstanding collection contained over 250 elm leaf beetles, but practically no other insects (Fig. 1). There was nothing different about this particular trap. It had been baited with ammonium carbonate and hung in an apple tree with elm trees nearby. Had only a few elm leaf beetles been trapped, we might think the beetles were caught by chance. But, when the trap was found plastered with 250 adult beetles, it was apparent that ammonium carbonate is strongly attractive to some species of beetles as well as to flies.

The trap was invented quite a few years ago by a young entomologist, Dr. Kenneth Frick of the Washington State Department of Agriculture. He was working with cherry fruit flies and needed a trap to sample and detect the populations. After many trials with carton-type traps, he came up with a dry-baited, sticky-sided trap that worked, the Frick trap.

Dr. Frick lined the insides of one-quart freezer cartons with his own special "stickum" and added powdered ammonium carbonate. After the eradication of cherry fruit flies in California, Frick's traps were used as "all-purpose" traps for detection of other flies. Since powdered ammonium carbonate is an attractant for many fruit fly species, its use in the Frick trap was continued.

What adaptations the versatile Frick trap may undergo in the future cannot be predicted. It is only an inexpensive pasteboard freezer carton, with the inside smeared with "stickum," baited with an attractive lure such as ammonium carbonate, and suspended by a string preferably in a host plant. The powdered bait is placed in the carton lid, then the perforated trap bottom is pushed into the lid to hold the lure. The Frick trap seems to have definite possibilities as an effective tool for pest detection.

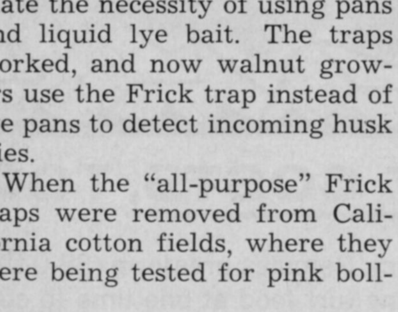


Fig. 2. Frick traps are made of pasteboard freezer cartons lined with a pasty "stickum" to catch insects. They are hung in host trees in filtered shade, preferably with foliage in front or slightly below, but never touching, the open end. Traps hang horizontally with the open end tipped downward to prevent moisture accumulation. An attractant, powdered ammonium sulfate, is placed in the lid, and then the perforated bottom of the carton is pushed into the lid to secure the bait.

Ho-hum...
another new herbicide...

This one is called Phytar 560! You'd think that manufacturers would run out of funny names . . . or would get wise to the fact that farmers are completely confused about all the new herbicides kicking around these days.

But we think you'll remember PHYTAR! It does things that none of the others have been able to do. It's a general, non-selective herbicide that completely eradicates all vegetation along roadways and ditches, around buildings and storage areas and in other non-crop areas. If you've been using weed oil to do these jobs you'll find PHYTAR vastly superior in at least five important ways: (1) It's more effective and *cheaper;* (2) There is absolutely no residual toxicity, (3) no staining, and (4) not nearly as much corrosion of your spraying equipment. (5) You'll eliminate the storage problem because one gallon of PHYTAR 560 (which is mixed with water when you're ready to apply it) is equivalent to 50 gallons of weed oil.

Try it! The name's PHYTAR . . . and it's a product of the Ansul Company, Marinette, Wisconsin.

Tordon . . .

a new vegetation management tool

By DR. MARK G. WILTSE
Plant Science Research and Development
Bioproducts Department
The Dow Chemical Company
Midland, Michigan

RECENTLY, a new herbicide was introduced that offers a solution to many of the vegetation control problems encountered by custom applicators. Technically, this herbicide is 4-amino-3, 5, 6-trichloropicolinic acid, and is known by the Dow Chemical Company trade name as Tordon.

It is a highly active systemic compound, effective on a wide range of broadleaved plant species. Sprays applied to the foliage of plants in the conventional manner produce growth responses similar to those from 2,4-D and 2,4,5-T. Initial reactions of the plant include curling of the leaves and twisted new growth. This is followed by gradual death quite similar to the effect produced by phenoxy herbicides. Most broadleaved plants are killed, while most grasses are not normally affected at application rates usually recommended for weed control.

Has High Safety Factor

Tordon is effective for the control of broadleaved weeds and woody brush and has a high safety factor in relation to man and animals. It has a low acute oral toxicity, with an LD_{50} value for white rats of 8.2 grams per kg. of body weight. Feeding tests with chickens, Japanese quail, swine, calves, and sheep show no problems stemming from accidental ingestion of the material. Experiments have been conducted to evaluate the effect of the herbicide on fish and other aquatic organisms, and here again, it displayed relatively low toxicity. No adverse effect on rats and dogs and no measurable histopathological tissue changes were indicated by 2-year feeding tests.

Kills Conifers

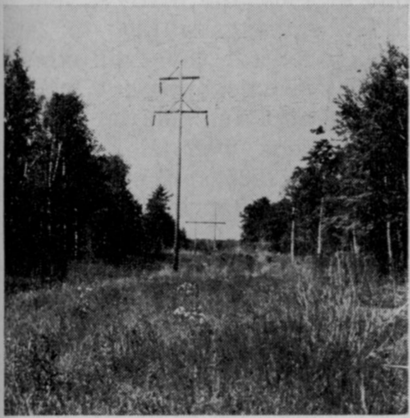
Initial leaf kill and brown-out are not as uniform nor as rapid on some species of brush sprayed with Tordon 101 Mixture as with sprays of 2,4,5-T and 2,4-D. Coniferous species, however, which are not effectively controlled by these herbicides, can be controlled readily with the 101 mixture. Leaf-stem sprays with the mixture have given excellent control of many of the most common woody plants, such as black locust, sassafras, persimmon, and hickory. The maple species are especially susceptible.

Tordon 101 Mixture should be applied to brush in the growing period from full leaf development in the spring until about three weeks before frost in the fall. As with other herbicides, growing conditions affect the results that can be expected. When applications are made to plants under stress because of lack of moisture, maximum results may not be obtained.

Experienced spray crews can apply the mixture safely and effectively to get the best results, with maximum protection to desirable vegetation nearby. Application by experienced crews working from hose lines with adjustable spray guns has been very effective; however, other methods of application are being evaluated.

At the present time, Tordon 101 Mixture containing a combination of 2,4-D and Tordon herbicides is recommended for the control of a broad range of woody plant species growing on industrial sites. This mixture is recommended at rates of 1 to 3

For unwanted woody plant control, Tordon 101 is best applied to brush between spring leaf development and 3 weeks after fall frost.



Control of regrowth is shown above where area ground cover has no brush after being treated with Tordon mixture along this right of way.

Combined with a particulating agent, Tordon can be used in aerial applications such as this, making it applicable for brush control along hard-to-get-at powerlines in difficult areas.

gallons per 100 gallons of water to be applied as a leaf-stem spray so as to thoroughly wet the root collar, stems and foliage of the brush. On some of the more resistant species, such as live oak and some species of ash, soil over the root area of the brush should also be sprayed to enhance total effect through root uptake.

Rainfall Aids Pellets

A dry formulation, Tordon 10K Pellets, can be applied to the soil for brush control. The pellets can be distributed easily with granular applicators or spread by hand over the root areas of plants to be killed. Applications have been effective any time there is no frost in the ground. Rainfall after application aids in leaching the herbicide into the root zone of woody plants. These pellets are particularly useful for spot treatment brush control or in areas where the use of spray equipment is uneconomical or hazardous. Treatments can be made early in the spring during periods of time when equipment and manpower are not used. A rate of 60 lbs. of Tordon 10K Pellets per acre has given control of such species as maple, conifers, locust, aspen and wild rose, while rates up to 85 lbs. per acre may be required for the control of black gum, oak and ash. For the control of a mixed stand of brush, a rate of 75 lbs. per acre of the pellets is recommended.

For effective spot applications, the pellets should be distributed evenly over the soil above the entire root system, from the stem outward to 1 ft. beyond the branch tips (drip line). For this type of application, Tordon 10K Pellets should be applied at 1 to 2 tablespoonfuls per 30 sq. ft. of soil surface. On sandy soils, or other soils easily leached, applications should be applied just prior to bud break in the spring, and higher rates of application should be used.

Most deep-rooted perennial weeds including field bindweed, Canada thistle, Russian knapweed, leafy spurge, bur ragweed, milkweeds, docks, larkspur, toadflax, horse nettle, and poverty weed have been controlled very effectively by Tordon sprays. Application can be made at any time after the ground thaws in the spring until freeze-up in the fall.

Because of the degree and range of effectiveness of this herbicide, care during application is a necessity. Where roots of desirable plants are exposed to treatment, this herbicide can cause serious injury or actually kill the plants. Small amounts of drifting spray can also damage desirable broadleaved plants. It is important that crews applying Tordon be trained in the correct practices for the handling and use of herbicide materials.

Preemergence Siduron Controls Crabgrass Safely in Four Turfgrasses

By
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and
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CRABGRASS and goosegrass are two weed pests that cause serious problems during the months of turf establishment in the spring. Previous studies have shown that most preemergence crabgrass herbicides are toxic to turfgrasses when applied at seeding time or within a few weeks after emergence.

Preliminary studies have shown that siduron[1] controlled crabgrass in bentgrass, Kentucky bluegrass, Merion bluegrass, redtop fescue, and Pennlawn red fescue when applied at seeding time without affecting germination.

In North Carolina, two tests were conducted to determine the effects of siduron on crabgrass and goosegrass, and also its effects on the establishment of several warm- and cool-season turfgrasses. One test was conducted in 1964 and another in 1965.

Test plots were set up in an area heavily infested with crabgrass at Raleigh, North Carolina; soil type is Cecil clay loam. Test rates of siduron were applied in 4-foot bands across triple-replicated strips of turfgrasses 3 feet wide. The five warm-season grasses tested were common bermudagrass, Tifton 328 bermudagrass, carpetgrass, centipedegrass, and Meyer zoysia. Three cool-season grasses were Merion bluegrass, Kentucky 31 tall fescue, and Pennlawn red fescue.

All eight grasses were plotted in the 1964 tests. Tifton 328 and Meyer zoysia were sprigged, and the other grasses seeded, on May 8, 1964. However, only the six seeded turfgrasses were planted in the 1965 plots, on April 16. Seedbeds were prepared by tilling in 8-8-8 fertilizer at the rate of 25 lbs./A. In mid-June after planting, additional 16-8-8 fertilizer was applied at 10 lbs./1,000 sq. ft. Plots were irrigated as needed during a three-week period after planting.

Siduron was applied immediately after planting (with a second treatment in some cases one month later). Rates in terms of pounds active ingredient per acre were 4, 6, 2+(4), 8, and 4+(4).

In September of each year, 1964 and 1965, the percent crabgrass control and goosegrass control was determined (Table 1). The number of each weed species in a random square foot sample in each plot was counted. This number was converted to percent on the basis of the number of weeds in untreated check plots. Turfgrass stand establishment was based on visual ratings which were converted to percent values based on untreated check plot stands.

Crabgrass Controlled

All rates of siduron gave excellent crabgrass control in 1964; but in 1965, the 6 lb./A. and 8 lb./A. rates gave 12% to 24% better control than all others. There was no apparent advantage to applying siduron in split applications over single treatments. In 1965, split applications gave somewhat less control of crabgrass.

None of the rates of siduron treatments controlled goosegrass adequately. The 8 lb./A. rate gave only 49% control in 1964, and 60% control in 1965 tests. In 1965, only the 4 lb./A. and 8 lb./A. rates were significantly different from the check plots.

Siduron Retards Four of Eight Grasses

Turfgrass stand establishment was determined on October 21, 1965, for both 1964 (Table 2) and 1965 (Table 3) tests. Results were based on visual ratings, and for ease of comparison, all data were calculated as percent of check plot turf establishment.

In both years, many siduron-

Table 1. Percent crabgrass control and goosegrass control from preemergence siduron treatments.

Siduron rates lbs./A. (a.i.)	% Crabgrass Control		% Goosegrass Control	
	Sept. 4, '64 17 wks. after treatment	Sept. 18, '65 22 wks. after treatment	Sept. 4, '64 17 wks. after treatment	Sept. 18, '65 22 wks. after treatment
4	98 a[1]	68 a	61 a	52 ab
6	93 a	92 a	43 a	18 bc
2+(4)*	95 a	80 a	45 a	18 bc
8	99 a	92 a	49 a	60 a
4+(4)*	99 a	75 a	69 a	28 abc
Check	0 b	0 b	0 b	0 c
Plants/sq. ft. in check	94	28	28	36

*Second application of 4 lbs./A. made approximately one month after the first application.
[1] Numbers followed by the same letter are not significantly different at the 5% level of probability, according to Duncan's Multiple Range Test.

[1] Siduron is technically called 1-(2-methylcyclohexyl)-3-phenylurea. DuPont's trade name for the herbicide is Tupersan.