CALIFORNIA TURFGRASS CULTURE
FORMERLY, SOUTHERN CALIFORNIA TURFGRASS CULTURE

VOLUME 25, NO. 2 SPRING, 1975

THE PRESENT AND FUTURE OF PESTICIDE LISCENSING

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California currently has a very comprehensive pesticide regulatory program involving pesticide registration, pesticide quality control, pesticide use enforcement, licensing, worker safety, and as a final check, environmental and residue testing.

The primary interest of this article is the licensing activities that currently, and in the future, will affect individuals in the landscape industry.

We will start out with the question "Who is required to be licensed?" Agricultural pest control operators, pesticide dealers, agricultural pilots, and agricultural pest control advisers must be licensed.

A person who applies pesticides, or uses any substance, method, or device for hire, must be licensed as an agricultural pest control operator to engage in any of the following activities: (a) control pests, (b) prevent, destroy, repel, mitigate or correct any pest infestation or disorder of plants, or (c) regulate, stimulate or otherwise alter plant growth by direct application to plants.

Any person, including manufacturers, distributors or retailers who engaged in any of the following business activities is required to be licensed as a pesticide dealer: (a) selling pesticides to users for agricultural uses, (b) selling to users any method or device for the control of agricultural pests such as biological agents, lures, or insect trapping devices, or (c) soliciting sales of pesticides by making agricultural use recommendations through field representatives or other agents.

A dealer's branch salesyard, store, or sales location must also be licensed. The term "agricultural use" came up in the definition of a pesticide dealer and is also involved in the definition of an agricultural pest control adviser.

The Food and Agricultural Code defines "agricultural use" as the use of any pesticide or method or device for the control of plant or animal pests or any other pests or the use of any pesticide for the regulation of plant growth or defoliation of plants.

Agricultural use includes uses in parks, golf courses, roadsides, cemeteries, and other similar areas. In other words, agricultural use includes all uses except those specifiically excluded. Excluded from agricultural use are the sales and uses of pesticides in properly labeled packages which are intended for home use, structural pest control, institutional and industrial uses, use under a veterinarian's prescription for the control of an animal pest, and uses by vector control agencies operating under a cooperative agreement with the Department of Health.

Any person who makes agricultural use recommendations or holds himself out as an authority or general adviser on any agricultural use, must be licensed as an agricultural pest control adviser. Exempted from this licensing, but not from the requirement of making written recommendations, are federal, state, county, and University of California personnel operating in their official capacities.

To obtain any license, the applicant must submit the proper application and fee and successfully pass a written examination. Applicants who fail their examination or any portion of an examination are entitled to one reexamination in the portion failed no sooner than 30 days or longer than 120 days. If the applicant is unsuccessful in a second try, he must submit a new application and fee if he wishes to try again.

Each license expires on December 31,. of the year issued. To renew, each licensee must submit the same fee as he submitted with his original application before January 1 of the next year to avoid penalty. The only exception to this is the agricultural pilot who may renew his license for $15 each year anytime before he operates in pest control.

The new applicant for an agricultural pest control adviser license must meet minimum qualifications involving a combination of education and experience.

Until January 1, 1976, the minimum qualifications consist of graduation from high school plus either (1) 30 semester units of college level curriculum in the agricultural or biological sciences or pest management, or (2) two years technical experience.

After January 1, 1976, the minimal qualifications consist of either (1) 60 semester units of college level curriculum in the agricultural or biological sciences or pest management, or (2) 30 semester units of the same curriculum plus two years of technical experience.

After January 1, 1980, the minimum qualification consists of either (1) a bachelor's degree in the agricultural or biological sciences or pest management, or (2) 60 semester units of the same curriculum plus two years of technical experience.

Before an agricultural pest control operator or an agricultural pest control adviser can legally operate, he must register with the County Agricultural Commissioner in each county in which he intends to work. The county may require payment of a registration fee and in the case of a pest control operator, even an examination.

Agricultural pest control operators must submit a pesticide use report to the County Agricultural Commissioner containing specific information. Most agricultural pest control must be recorded within seven days of each job.

Certain types of pest control such as residential and right-of-way may be submitted monthly in a summary form.

A pesticide dealer is required to prepare and maintain

*From: **Proceedings of the 1975 Turf and Landscape Institute.**

****California Department of Food and Agriculture., Sacramento.**

for one year, a record of all pesticides sold or delivered. These records must show the name of the person making each sale and be available to the Agricultural Commissioner or Director upon request.

If the person making the sale is not a licensed agricultural pest control adviser, he may not make an agricultural use recommendation. When a sale is made and no recommendation is made, the invoice or delivery slip must state "no recommendation has been made covering the use of the material covered by this invoice" or a similar notice. This notice must be delivered to the customer no later than the time the pesticide is delivered.

When a restricted material or a restricted herbicide which requires a permit is sold, the dealer must obtain a copy of the purchaser's permit or have him sign a statement that he has a valid permit. This must be done before the pesticide is delivered.

The agricultural pest control adviser must make all agricultural pest control recommendations in writing and furnish a signed and dated copy to the grower immediately. When a pesticide is recommended, a copy of the recommendation must also be furnished to the dealer and applicator no later than the time the pesticide is delivered.

Certain information is required on a written recommendation, A form has been designed for use by Department of Food and Agriculture employees and County Agricultural Commissioners.

In October 1976, we are faced with a certification program involving approximately 50,000 applicators.

The Federal Insecticide, Fungicide, and Rodenticide Act requires among a number of things that all pesticides be classified as either "general use" or "restricted use." General use pesticides will be available to anyone with the requirement that they be used in accordance with their labeling.

Restricted use pesticides, after October 1976, can be applied only by certified applicators or under the supervision of a certified applicator.

The federal law provides for two types of applicators; private and commercial. To be a private applicator, you must be a farmer. If you are not a farmer and you use restricted use pesticides, you must be a commercial ap plicator.

California has a list of restricted materials. EPA has not yet classified pesticides into the "general use" or "restricted use" classification. Until they do, we don't know the full impact of certification on California.

EPA is not going to certify applicators. Responsibility for this activity lies with the states who must develop a state plan acceptable to EPA.

Commercial applicator categories have been established by EPA. California will probably use all of them with a few subcategories to meet our needs.

For the certification of private applicators, we foresee a combination of training, examination, and our current permit system.

If you intend to be a commercial applicator, you can look forward to an examination preceded by adequate training.

The Department of Food and Agriculture has been designated by the Governor as the lead agency to carry out the certification of applicators. We are currently developing a state plan and will be able to share a draft of this plan with the pest control industry soon.

WORKER SAFETY REGARDING PESTICIDES*

*W. Robert Bowen***

SELECTING THE PESTICIDE

The selection of a pesticide is a primary consideration of an effective pest control program. It determines, in part, the effectiveness of control measures and possible hazards to the applicator, other workers, livestock and pets, crops and other plants, consumers, wildlife, and beneficial insects.

General Considerations

Before selecting a pesticide, carefully consider the following:

* The specific pest(s) to be controlled. (Identify the pest or have it identified by someone competent to do so.)
* Determine whether the pest population is of economic importance, health importance, a significant nuisance, or otherwise detrimental.
* Other possible methods of control--cultural, biological, or integrated control.
* Location of the pest. Location will determine the type of pesticide you may use effectively and safely. For example:
  - Fairway or green -
  - Trees or shrubs -
  - Water hazards or wooded areas -
* Will there be a drift problem?
* Select a material with the lowest toxicity adequate for the job.
* Will the chemical leave a residue?

THE PESTICIDE LABEL

Information on pesticide labels has been called the most expensive literature available. The research and development that lead to the wording on a label frequently cost millions of dollars. The combined knowledge of laboratory and field scientists, including chemists, toxicologists, pharmacologists, pathologists, entomologists and others in industry, universities and government is used to develop the information found on the label.

The importance of READING THE LABEL cannot be stressed too often. The information that appears on the label is put there for your information and your protection. If it is read, understood, and all of the directions are followed, the likelihood of misusing the material or of having an accident with the pesticide is remote. This is why we so often stress that "the most important few minutes in pest control is the time spent in READING

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* Excerpts from the "Pesticide Information and Safety Manual" University of California, Cooperative Extension, Berkeley, Califomia. (Given as a 35 mm slide presentation.)

*From: The 1974 Proceedings of the California Golf 'Course Superintendents' Institute. pp 57-65.

**Extension Entomologist, U.C. Riverside

THE LABEL." THE LABEL IS A TOOL. LEARN TO USE IT.

What's on the Label

The printed material on a pesticide label has all of the necessary information and instructions for the effective and safe use of the pesticide. It must, by law, include the following:

* Brand name
* Intended use of product
* Inert ingredients
* Directions for use
  Pests to be controlled
  Crops, animals or sites to be treated
  Dosage, time and method of application
  Warnings
  To protect user
  To protect beneficial plants and animals
  KEEP OUT OF REACH OF CHILDREN
* Net contents
* Name and address of manufacturer or. registrant
* USDA registration number

When You Should Read the Label

1. Before you purchase the chemical, READ THE LABEL to determine:
   * If this is the chemical you need for the job. Never purchase or select for use a pesticide based on the color of the label. Labels of the same color and general makeup may contain widely different active ingredients.
   * Whether this material is too toxic or hazardous to be used safely under your conditions.
   * Concentration in per cent or pounds per gallon of active ingredient.
   * Formulation is suitable for your equipment.
2. Before you mix the material, READ THE DIRECTIONS to determine:
   * Protective equipment necessary when handling it.
   * Warnings and antidotes, when required.
   * What you can mix with it (compatibility).
   * How to mix it.
   * How much to use.
3. Before applying, READ THE DIRECTIONS to determine:
   * Safety measures necessary for applicator.
   * To what it can be applied.
   * when to apply (including waiting period on crops and animals).
   * How to apply.
   * Rate of application.
   * Restrictions of use.
   * Special instructions.
4. Before storing or disposing of the pesticide containers, READ THE DIRECTIONS to determine:
   * Where and how to store.
   * Where it should not be stored.
   * What it should not be stored with.
   * How to decontaminate and dispose of the container.
   * Where to dispose of left-over pesticides or their containers.

Key Words and Symbols on Labels

Many of the terms used on labels are set by law.

Certain "signal words" such as "DANGER," "POISON," "WARNING," "CAUTION," and the skull and crossbones symbol are required by law to appear on the label. They indicate the degree of toxicity of the pesticide, based on LD_{50} or LC_{50} values of the chemical.

LD means lethal dose and LD_{50} means lethal dose that will kill 50 percent of a large population of test animals. LC means lethal concentration and LC_{50} means lethal concentration that will kill 50 percent of the test animals.

TOXICITY RATINGS OF CHEMICALS USED IN PEST CONTROL

Toxicity values are expressed as:

* Acute oral LD_{50} in terms of milligrams of the substance per kilogram (mg/kg) of body weight of the test animal;
  "Acute oral" refers to a single dose taken by mouth or ingested.
* or Acute drmal LD_{50} in terms of mg/kg;
  "Acute dermal" refers to a single dose applied directly to the skin (skin absorption).
* or inhalation data LC_{50} in terms of micrograms of air (ug/l) or parts per million by volume of gas or vapor (ppm) . One microgram (ug) equals one millionth of a gram.
  "Inhalation" refers to exposure through breathing or inhaling.

Thus the signal words "DANGER," "POISON," and the skull and crossbones symbol are required on the labels for all highly toxic compounds. These materials all fall within the acute oral LD_{50} range of 0 to 50 mg/kg.

The word "WARNING" is required on the labels for all moderately toxic compounds. These materials all fall within the acute oral LD_{50} range of 50 to 500 mg/kg.

The word "CAUTION" is required on the labels for all slightly toxic compounds. These chemicals all fall within the acute oral LD_{50} range of 500 to 5000 mg/kg.

No special signal words or symbols are required on labels for compounds that have an acute oral LD_{50} greater than 5000 mg/kg. However, unqualified claims for safety are not acceptable on any label and all labels must bear the statement, "Keep out of the reach of children."

Thus a knowledge of the meaning of the signal words and symbols forewarns the user of potential hazards associated with the chemicals.

Do not depend exclusively on toxicity values as the only factor to be considered regarding the toxic effect of a chemical on humans or other animals. Users of pesticides should be concerned with the hazard(s) associated with the exposure to the chemical and not exclusively the toxicity of the material itself. These two terms are not synonymous.

Toxicity is the inherent capacity of a substance to produce injury or death.

Hazard is a function of two primary variables, toxicity and exposure; and is the probability that injury will result from the use of a substance in a given formulation, quantity, or manner. Some hazards do not involve toxicity to humans, or other animals. For example, sulfur, oils, and numerous other chemicals are considered safe or relatively safe to animals, but may pose considerable hazard to some plants (phytotoxicity) .

A compound may be extremely toxic but present little hazard to the applicator or others as used:

* in a very dilute formulation,
* in a formulation that is not readily inhaled,
* used only occasionally and under conditions to which humans are not exposed.
* used only by experienced applicators who are properly equipped to handle the chemical safely.

On the other hand, a chemical may exhibit a relatively low mammalian toxicity but present a hazard because it is normally used in the concentrated form, which may be readily absorbed or inhaled, or it may be used frequently by the nonprofessional, i.e., home gardeners, etc., who are not aware of the possible hazards to which they are being exposed.

Human experience with exposure to chemicals is the best guide to human toxicity. No actual scientific tests have been conducted in which humans have been subjected to lethal doses of chemicals. However, the effects of some chemicals on humans have been obtained from reports of accidental exposures or suicides. This information, at best, is usually incomplete or fragmentary and we must therefore rely upon data obtained from animal tests. The toxicity values obtained from these tests may vary according to the species of test animal used, the test method used, sex of the species, whether the animals have been fasted or not, the state of their health, the purity of the chemical tested, the medium in which the toxicant is administered, the route of administration, the length of time and frequency of exposure. Therefore, these data cannot be interpreted directly in terms of human toxicity, and extrapolation of them as to their effect upon humans must be done with caution.

GENERAL SAFETY INSTRUCTIONS FOR THE SAFE USE OF PESTICIDES

Before You Begin Application

* Commercial pest control operators and other applicators of large quantities of organophosphorus pesticides should contact their physicians at the beginining of the season, or before using these materials, and submit to a blood test. At this time the person(s) should inform the physician of the types of pesticides he will be using. A good understanding should be established between the employer, the applicator, and the physician regarding the availability of the physician's services and certain standard charges for such services. While discussing the pesticides to be used with your physician, ascertain that he has a current list of phone numbers for the Official Poison Information Centers in the event that he is not familiar with all of the types of pesticides, their antidotes, as well as signs and symptoms of pesticide poisoning.
* Know the legal requirements of agricultural employers to provide medical supervision for employees who regularly apply phosphate esters.
* Know the signs and symptoms of organophosphorus and carbamate insecticide poisoning.
* Know what you are to do in the event of an accident. PLAN AHEAD. Call your physician immediately in the event of an accident.
* Have your physician's phone number posted by your phone. In an emergency, time is extremely important.
* Consider wearing a Medi-Alert emblem.
* Explain the safe use of pesticides to employees. Make sure they understand.
* Check your application equipment for leaks, clogged lines, nozzles and strainers.
* Calibrate your equipment frequently for proper output using water or other inert material.
* Make sure plenty of clean water, soap, towels, and a clean change of clothing are available.
* All persons who plan to apply "injurious materials" or "restricted materials" as defined in the State of California, Department of Agriculture Regulations, must obtain a permit for use of such materials from the local county agricultural commissioner and adhere closely to conditions under which such materials may be applied.
* Do not permit delivery of pesticides unless a responsible representative is on hand to receive and properly store them.
* Make sure that humans have been warned and livestock and pets that may be exposed have been removed from the area to be treated.

After a Pesticide Application

* Post your property, if required.
* Do not enter premises or permit other to do so until the proper time interval has elapsed.
* Clean your application equipment thoroughly. Clean and store your clothing and protective equipment after each use.
* Always wash yourself thoroughly and change clothing and boots after using a pesticide.

MIXING AND APPLYING PESTICIDES

* Wear clean and proper clothing and other protective devices when called for.
* Change respirator filters as frequently as called for by the manufacturer.
* Never work alone when handling hazarous pesticides.
* Workers should observe each other carefully for any change in their normal manner or action.
* Do not allow children or other unauthorized persons in the vicinity of mixing, loading, or application.
* Never eat, drink, or smoke when handling pesticides.
* Always wash thoroughly before eating, drinking, or smoking after handling pesticides.
* Read the label AGAIN; check contents again; follow precautions given on label.
* Follow label directions for mixing and applying chemicals. Do not deviate from these directions.
* If it is absolutely necessary to handle toxic pesticides at night, make sure there is adequate light.
* Mix chemicals outside where there is adequate ventilation.
* Use only recommended amounts and double check your measurements.
* Do not combine pesticides unless the combination is called for on the label or until you have consulted an authority.
* Handle concentrated chemicals with extreme cure.

* Pour liquids, power and dusts slowly to avoid splash, spill or drift.
* Open sacks with a knife rather than tearing.
* Always stand upwind when mixing or loading pesticides.
* Avoid inhalation of chemical, dust and fumes.
* Avoid skin contact with concentrated chemicals.
* If the concentrate is spilled or splashed on your skin or in your eyes, wash immediately.
* Do not wipe your hands on your clothing if chemical has been spilled on your gloves. This will contaminate your clothing and the chemical may be absorbed by your skin.
* If a concentrate is spilled on the floor or ground, clean it up or dilute it to reduce possible hazard of contact. Some chemicals in the concentrated form will remain in toxic quantities in the soil for many months.
* Use separate equipment for applying hormone type herbicides (such as 2,4-D) in order to avoid accidental injury to susceptible plants.
* Check your application equipment frequently to insure proper function and dosage rates.
* Do not blow out clogged hoses, nozzles or lines with your mouth.
* Do not contaminate apiaries, fish ponds, lakes, streams or canals.
* Do not apply pesticides when drift will be a problem.
* Do not work in drift or runoff.
* Provide proper supervision of employees.
* In the event of a serious exposure to either organophosphorus- or carbamate-type insecticide, do not attempt to drive a vehicle on the highway.
* When choline&erase tests show that your level is below your normal level, you should not work with any more of the cholinesterase inhibitors until further tests show that your level is back to normal. This holds true even if there is "just one more load to go." Any abnormal cholinesterase level or other signs or symptoms may indicate the onset of pesticide poisoning.
* Do not leave pesticides unattended in the field or at the site of operation.
* Do not leave application equipment partially filled with unused chemicals at the end of the operation. Pesticides should be used immediately after mixing to avoid possibility of chemical changes occurring in the tank.
* Plan your application carefully so that you will not have to dispose of large quantities of left-over chemicals.
* Bathe and change clothing at the end of each day.
* Launder clothing after each day's use.

PROTECTIVE CLOTHING AND OTHER SAFETY DEVICES

The use of protective clothing and other safety devices offers some protection against skin contact and/or inhalation of certain pesticides by the operator, but it does not eliminate the necessity for other essential precautions.

Coveralls, rainsuits, head and neck coverings, boots, gloves, goggles, and respiratory devices are designed to protect the person who is handling or applying pesticides from direct contact with the material. Pesticides most frequently enter the body by dermal contact and the concentrated formulation is the most serious threat in this respect. Therefore, be especially careful when removing concentrated pesticides from their containers, mixing, and filling application equipment. However, continuous exposure to dilute formulations of some pesticides can be equally as dangerous and proper precautions should be followed at all times.

Check the label of the pesticide container! If it calls for the use of certain pieces of protective equipment, wear them.

Gloves

Wear natural rubber gloves when handling organophosphorus or carbamate insecticides unless another type is suggested by the pesticide manufacturer. Always check gloves very carefully for tiny (pinpoint) holes. Fill with water and squeeze; if water comes out, discard the gloves. For other pesticides, follow the manufacturer's suggestion. Never use leather or cotton gloves when handling or applying pesticides. Leather or cotton will absorb the toxicant and provide a constant exposure to the chemical. These types of gloves and those with holes are potentially a greater hazard than if no gloves are worn.

Coveralls or Waterproof Rainsuits

To reduce skin contamination, wear clean coveralls that cover the entire body. If coveralls will be wet through by mist, spray or spillage, wear a waterproof rainsuit. After each use, wash coveralls and rain gear with soap and water.

Head and Neck Coverings

Protect the hair and skin about the head and neck from contact with pesticides. Several types of available headgear include waterproof rainhats and washable, safety, hard hats and caps. Waterproof or repellent parkas may be used to protect the head and neck at the same time. Do not wear old felt hats or other absorbent types of headgear, as they absorb the pesticides, especially in the sweatband, and thereby provide a continuous and very dangerous skin contact.

Boots

Wear only rubberized boots when handling or spraying pesticides on a large scale. Both leather and canvas absorb chemicals and hold them in contact with the wearer. Boots should be washed and dried thoroughly, inside and out, as frequently as needed to remove any pesticide contaminant.

Goggles

Good, effective nonfogging goggles are readily available and should be worn when there is any chance of a chemical coming in contact with the eyes. It is especially important to wear goggles when spray or dust drift may be encountered. Keep goggles clean at all times, especially the headband that is in close contact with the head and is often made of a material that more readily absorbs chemicals than other parts of the goggles.

Respiratory Devices

A respiratory device is one of the most important pieces of equipment for both the commercial pesticide applicator and the man who does his own spraying. It will serve you well to own these protective devices and know how to use and take care of them properly.

The two kinds of respiratory protective devices in general use are chemical cartridge repiratiors and gas masks.

Most respirators are designed as half-face masks that cover the nose and mouth but do not protect the eyes. They have one or two cartridges attached to the facepiece by a clamp or secured in a holder. These types usually are equipped with one-way valves that force the inhaled, air through the cartridges but bypass the exhaled moist breath around the cartridges.

Gas masks usually cover the entire face. Their facepieces are made to hold a canister directly or to connect the canister by means of a flexible hose.

Respirator cartridges usually contain an absorbing material such as activated charcoal. All the respirators mentioned in the latest USDA report also have efficient filters that remove dust and spray particles and thus prolong the life of the absorbing material. Gas mask canisters always contain more absorbent material and longer-life filters than respirator cartridges.

The life of chemical-absorbing cartridges or canisters vary according to the concentrations encountered and also are affected by humidity, temperature, and volume of breathing.

USDA tests show that these devices gradually lost their effectiveness during storage because of the exchange of air within the unit due to changes in temperature and atmospheric pressure.

Protective devices must be used when handling pesticides during the loading of spray equipment, when containers are being disposed of, and whenever operators are exposed to obvious amounts of dusts or mists of the more dangerous pesticides. Field operators who may be exposed continuously during the day or for successive days to small amounts of toxic pesticides-even those not readily detectable should use respirators as a precaution.

When respirators are used, the following practices are necessary

* The respirator should be fitted properly on the face. Adjust headbands just tightly enough to insure a a good seal. Manufacturers can usually supply special facepieces if the standard one does not fit.
* Change filters twice a day or oftener if breathing becomes difficult.
* Change cartridges after 8 hours of actual use, or more often if any odor of the pesticide is detected.
* Remove filters and cartridges and wash after use. Rinse it thoroughly to remove all traces of soap. Dry the facepiece with a clean cloth that is not contaminated with the pesticide. Place the facepiece in a well-ventilated area to dry.
* Store the respirator, filters, and cartridges in a clean, dry place-preferably in a tightly closed paper or plastic bag.

BROADLEAF WEED CONTROL IN TURF

*Clyde Elmore**

At the 1974 California Golf Course Superintendents Institute, Clyde Elmore presented a summary of the broadleaf weeds common to turf and the susceptibility of those weeds to certain herbicides. Also, grass phytotoxicity from various herbicides was presented. The summary tables from that presentation are given below for reference purposes.

TABLE I-Susceptibility of Broadleaf Weeds to Several Postemergence Herbicides

Plant Species	2,4-D W.S. amine	2,4-D O.S. amine	silvex	mecoprop	MCPA	dicamba	bromoxynil*
dandelion	S	S	S	MS	MS	MR	MR
English daisy	MR	MS	MS	MR	MR	S	—
broadleaf plantain	S	S	S	S	MS	MR	MR
buckhorn plantain	S	S	S	MS	S	MR	MR
common chickweed	MR	MR	MS	MS	MR	S	MR
mouseear chickweed	MS	MS	MS	S	—	MS	MR
soliva	MR	MR	MS	MS	—	MR	S
byzantine speedwell	R	R				—	
white clover	MR	MR	S	S	MS	S	MS
burclover	MR	MR	S	S	MS	S	MS
yarrow	MR	MS		MR-MS	—		
black medic	R	MR	S	MS	R	S	—
knotweed	S*	S*	MS	MR	MR	S	S*
pearlwort	MR	MR		S			—
spotted spurge	MR	MS	MS	MR	MR	MS	S*

S = susceptible
MS = moderately susceptible
MR = moderately resistant
R = resistant
— = insufficient information
* = young weeds only

*Extension Weed Scientist, U.C. Davis

TABLE 2-Safety to Grass Species with Broadleaf Herbicides

Herbicide	bentgrass*	Kentucky bluegrass	fine fescue	tall fescue	bermudagrass*	ry eg ra s
2,4-D W.S. amine	MS	R	MR	R	R	R
2,4-D 0.S. amine	MS	MR	MR	R	R	R
2,4-D L.V. ester	S	MR	MR	R	R	—
dicamba	MR	R	MR	R	R	R
mecoprop	MR	R	R	R	R	R
MCPA	MR	R	R	R	R	R
si lvex	S	MR	MR	R	MS	—
bromoxynil	MR	R	R	R	R	R

R = resistant to rates well above those needed for broadleaf weed control
MR = moderately resistant
MS = moderately sensitive-injury often results
S = sensitive
* = known varietal responds
— = insufficient information

GRASSY WEEDS IN TURF*

Victor A. *Gibeault* **

Many grasses often can be found in a turfgrass sward and because of differences in color, texture, growth habit, some can be considered weeds. The most common we grasses in California include crabgrass *(Digitaria ischaemum and D. sanguinalis)* , goosegrass or silver crab (Eleusine *indica),* velvetgrass *(Holcus mollis or H. lanatus),* dallisgras *(Paspalum dilatatum),* kikuyugras *(Pennisetum clandestinum),* and such examples as tall fescue in Kentucky bluegrass, rough stalk bluegrass in tall fescue, bentgrass in bluegrass, bermudagrass in cool season turfs, etc. The first question that can be asked is "How did they get there?" and the second is "How can they be removed?"

Weedy grasses can invade desirable turf through numerous avenues. Examples would be 1) improper management practices, 2) seed source, 3) sod, stolons, plugs, 4) topdressing, 5) equipment and 6) encroachment from unsanitary surrounding areas.

1. *Cultural Practices*

There are five primary management practices that are commonly used by turf managers. These include mowing, fertilization, irrigation, aeration and vertical mowing. Misuse of one or more of these practices often leads to a situation where grassy weeds can become established. As examples, Kentucky bluegrass that is continuously mowed too closely leads to a weakened grass stand of poor density. Light is allowed to penetrate (stimulating seed germination), temperatures at plant level increase (lack of shading), carbohydrate depletion occurs, roots restrict, disease incidence increases, and before long unwanted grasses are present. Maintaining inadequate fertility levels can give a similar response. If a turf is irrigated too little (selection toward drought tolerant grasses, i.e. bermudagrass) or too much (selection toward crabgrass, rough stalk bluegrass, velvetgrass) the end result is an undesirable turf stand. Likewise, cultivation, either aerification or verticutting, at times of minimum turfgrass growth, can foster a situation where unwanted plant material can become estak lished.

2. *Seed*

Turfgrass seed can be a source of grassy weeds. The use of certified seed will indicate the quality on the label. The following will be shown:

Kind	— Species and variety
Purity	— Percentage of stated kind
Crop	— Percentage other crop present
Inert	— Chaft, dust
Weed	— Percentage of seed from plants considered weeds.
Noxious Weeds	— Percentage of seed from plants legally termed noxious.
Germination	— Percentage germination at date tested.
Origin	— Growing location of seed crop.
Lot No.	— For identification purposes.

There are two indices of potential problems. The first is in the crop category. As an example, tall fescue is considered a crop for certification purposes, however, tall fescue in a bag of Kentucky bluegrass would be named a weed by the turf manager. The second is percentage weeds. Although the weeds identified could be broadleaved weeds, they could also be grassy weeds such as velvetgrass, annual bluegrass, etc. Of course, any seed containing noxious weeds should not be used for turf purposes.

3. *Sod, Stolons, Plugs*

Grassy weed movement can occur via the transfer of vegetative plant material. Practically all sod farms take precautions against this source of weed invasion: in fact, most farms will not sell sod, stolons and plugs that are so contaminated. The local transfer of sod between facilities or within a facility, however, can result in the spread of grassy weeds.

4. *Topdressing and Soil Movement*

The fact that weed seeds can be carried in unsterilized topdressing is so very well known that little discussion is needed. Nevertheless, it happens!

5. *Equipment*

Seed and vegetative plant material of grassy weeds can be spread by maintenance equipment. If one wants to insure a 100% stand of kikuyugrass, simply mow a kikuyu area prior to mowing the remainder of the turfgrass area. In a few years success will be realized.

6. *Invasion from Surrounding Areas*

A source of grassy weed invasion can frequently be found adjoining a well cared for green, fairway or tee.

*From: The 1974 Proceedings of the California Golf Course Superintendents' Institute. pp 11 l-l 13.
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Whether the sources are ditches, roughs or fence rows, the potential contamination from unsanitary areas is frequently the source of problems. Preventative maintenance such as weed control, seedhead suppression, and mowing in such areas can curtail future weed encroachment and the small intial investment more than compensates for the possible large fund allocations.

The previously mentioned factors either singly or in combination usually account for the presence of unwanted grass species. In addition to changing improper cultural practices and being aware of weed sources, what can be done to rid an area of grassy weeds once they are established? Fortunately, herbicides are available to selectively solve some problems. The methods presented in Table 1 are intended as guidelines. Check additional resource materials and read label directions carefully prior to embarking on a chemical control program.

TABLE I-Chemical Control of Grassy Weeds in Turf*

Weed	Annual	Perennial	Germination Date	Preplant	Control: Preemergence: Bent	Bermuda	Kty. Blue	Fescue	Postemergence
Crabgrass	X		Variable **Jan.-May, June** Depending on area	Methyl bromide Calcium cyanamide Metham Dazomet Amitrole **Cacodylic acid** Paraquat	Bensulide	**Bensulide** **DCPA** **Terbutol** **Benefin**	**Bensulide** **DCPA** **Terbutol** **Benefin**	**Bensulide** **DCPA** Benefin	DSMA AMA
Goosegrass	X		Variable Feb.-June Depending on area	Same as above	Bensulide	Bensulide	Bensulide	Bensulide	
Velvetgrass		X		Dalapon **Dazomet** **Metham** Methyl bromide	–		–	–	MSMA in bermuda, Kty. blue
Dallisgrass		X	–	Same as above		–		–	**DSMA, MSMA**
Kikuyugrass		X	–	Methyl bromide Metham					DSMA in Bent **MSMA in bermuda, Kty. blue.** fine fescue

*From: Guide to Turfgrass Pests, University of California Leaflet 209, March 1973.

CALIFORNIA TURFGRASS CULTURE
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Riverside, California 92502
Editors, Victor B. Youngner and Victor A. Gibeault

CALIFORNIA TURFGRASS CULTURE is sponsored and financed by the regional Turfgrass Councils and other turf/landscape organizations. Subscription to this publication is through membership in one of the councils listed below.

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