October 1989

LAWN INSTITUTE

Harvests

Volume 36 Number 3

THE HARVEST MIX

This issue of Harvests focuses on conference topics. Four are on turfgrass and water issues; 1 on turfgrass competition; 5 are concerning pesticides; 1 on shade effects on turf care; and 1 on turf nutrition strategies. There is also an update on benefits of lawns which continues to be one of the topics most in demand in our office.

We hope you find these informative and of value.

TWENTY-FIFTH ANNUAL NEBRASKA
TURFGRASS CONFERENCE

Omaha, Nebraska
January 13-15,1987

Water Quality and Turf Growth

Dr A E Dudeck
University of Florida

What is water [H2O] that it is so important to all life on earth ? Often we only think of the quantity of water needed for lawns and sports turf. But quality of water is often of critical importance. Dr Al Dudeck has reviewed this topic of water quality and believes that we all should be aware of the following:

- Water is:
  - the most abundant compound on earth;
  - a constituent of life;
  - used in all industrial processes;
  - there is no substitute for water.

- Young people are 90 percent water; old people are 75 percent water. Turf is composed of 75 to 80 percent water.

- Water is used in/as:
  - photosynthesis;
  - a solvent;
  - transport systems;
  - a catalyst;
  - creating turgidity;
  - soil microbial systems.

- Evapotranspiration is loss of moisture from soil and plants.

- One pound of plant dry matter takes 1000 pounds of water to produce.

- One ton of steel takes 30,000 gallons of water to produce.

- Our water consumption is the highest in the world - up to 300 gallons of water a day per person.

- From water use, we are experiencing:
  - salt water intrusion;
  - land settlement;
  - loss of atmosphere.

- A lack of water may be the most critical national problem in the years ahead.

- The amount of water on earth is fixed. But, the demand on its use increases.

- Water uses vary from rural to residential urban to steam generation to agricultural. In the southwest the problem is quantitative. In the rest of the United States, the problem is qualitative.

- Seeding clouds is practiced in an attempt to obtain more rainfall.

- As fossil fuels are used as a source of energy, there is concern that use of oxygen and release of carbon dioxide and other gasses will create a "greenhouse effect" that will result in the world getting warmer.

- Acid rain is also of concern. Normal rain has a pH of about 5.6; acid rain has a lower pH- about 4.0.

- Ninety-seven percent of the earth's water is in the oceans.

- Three percent of the earth's water is fresh. Of that, 75 percent is in the form of ice and snow and 25 percent in rives and lakes. 1.2 percent is surface water and 98.8 percent is groundwater. Overall, we are overpumping available water, and polluting surface and groundwater.

- The cost is still very high to get salt out of sea water.

Conference Topics

Water Quality and Turf Growth cont

- Contaminants in water include:

  - salt;
  - SAR;
  - sediments;
  - nutrients;
  - pesticides;
  - element hazards;
  - radionuclides;
  - miscellaneous - gasoline.

- Highest quality comes from wells.

- Rivers and streams have lower quality water. Springs and small streams are a very limited source.

- Now consider use of waste water for growing plants. Some of this could be food processing waste water.

- Effluent could be liquid gold for the turf industry. There could be 70 to 100 gallons of waste water a day available per dwelling unit. Turf is a natural for effluent water. It is a perennial. It has a high water requirement. The turf can be used to clean the water and put it back in the subsoil.

- Waste water comes from:

  - toilet - 40 percent;
  - shower - 30 percent;
  - laundry - 15 percent;
  - kitchen - 10 percent;
  - other home areas - 5 percent.

  60 percent of this is gray water. The 40 percent from toilet needs to go to the treatment plant.

- Why should drinking water be used to flush the toilet ?

- The Clean Water Act could change much in the United States, but politics gets in the way. State and local government involves a complex political system.

- There must be a greater appreciation of water resources management.

P.O.BOX 108

In response to
"The Fun Side of a Lawn"
July 1989 issue

ODE HERE - A DIFFERENT BENT

A poetess named Beverly
Put verse together quite readily;
But few could surpass
Her odes about grass
Even when thinking quite cleverly.

She talked about turf
And how it grows in the earth.
She showed Ben some bent
And Carrie St Augustine
Eliot said, that is disgustin'.

Those lines about voles & gophers
And disease in my clovers
Left me curled up in fright
Along with my blight
And unable to sleep until night.

The weeds that I see
I just spray with 2,4-D
Until biological control
Can take on a new role
Then, perhaps my spurge
Will give up the urge.

So children if you passed
A place that is grassed
And you're concerned about soil
particle size,
Think too about roots
As you walk on with your boots
You will be in for quite a surprise.

Do not feel too odd
When you have trouble with your sod
Just give a quick toot
To The Lawn Institute
For an answer that's hard to refute.

The reason for this rhyme
Is to say I don't have the time
To study all the vagaries of grass.
The answer to me is in Beverly C
Who is getting her PhD "G".

- Mike Bladon
Director of Grounds
University of Guelph

Turfgrass Water Use

Dr Robert C Shearman
University of Nebraska

With prospects for water shortages, particularly in urban locations, on the increase, home gardeners need to know more about turfgrass water use. Dr Bob Shearman is an authority on this topic and he lists the following points for your consideration.

- There is need to know turfgrass water use rates on both a short and long term basis.

- Water shortages occur on a regular basis. At the same time, there is an ample supply in other areas. Thus, water distribution is the issue and it is likely to affect all of us.

- Drought resistance may take the following three forms:

  - avoidance;
  - tolerance;
  - escape.

- Avoidance mechanisms include:

  - reducing evapotranspiration;
  - reducing radiation absorption;
  - maintaining a high root to shoot ratio;
  - promoting deep roots;
  - redistribution of roots.

- Water is required by grass plants for growth plus transpiration and evaporation. Growth uses only 1 percent of the water. Evapotranspiration uses 99 percent of the water. In effect, turf water use is evapotranspiration.

- Water use efficiency is related to desired aesthetic and functional aspects of turfgrass quality. For example, a golf green and school grounds have different water use efficiencies. The objective is to produce the best turf quality with the least water.

- Evapotranspiration varies with the time of year. It is least in the fall; medium in spring; and most in the summer.

- Rough bluegrass and red fescue use more water than Kentucky bluegrass and perennial ryegrass.

- The environment influences water use. For example, more water is needed when:

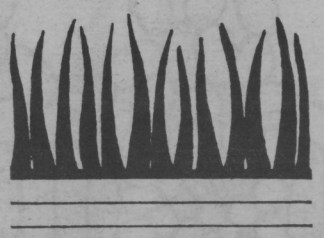
  - sun's radiation is high;
  - temperatures are high;
  - humidity is low;
  - wind is strong.

- Low water use per day would be about 4 millimeters. High water use per day would be about 12 millimeters. One inch of water a week may be used as a rule of thumb.

- Cultivars vary in water use. For example, Adelphi Kentucky bluegrass water use rate is less than that for Touchdown, Park, Sydsport or South Dakota Common. Rebel has a lower water use rate than Mustang, Adventure and Houndog. The water use rate for Kentucky-31 fescue is the highest. The potential for developing cultivars with low evapotranspiration should be good.

- The leaf area has an effect on evapotranspiration. For tall fescues, there is less evapotranspiration when there is more leaf area. There is more evapotranspiration when there is less leaf area. This is a matter of canopy resistance. The more dense the canopy, the less water gets out.

- Adelphi has a slower vertical extension rate and a higher verdure than other grasses. Thus Adelphi has low evapotranspiration. Need grasses with high verdure and high shoot density and low vertical elongation of leaves to make for a slower water loss.



Cultural Practice Effects on Water Use

Dr David D Minner
University of Missouri

Lawn and turfgrass management involves more than just the use of water. Some cultural practices have their own distinct influence on water use. It's good to keep these relationships in mind. Dr Dave Minner has helped us to do this by placing emphasis on the following.

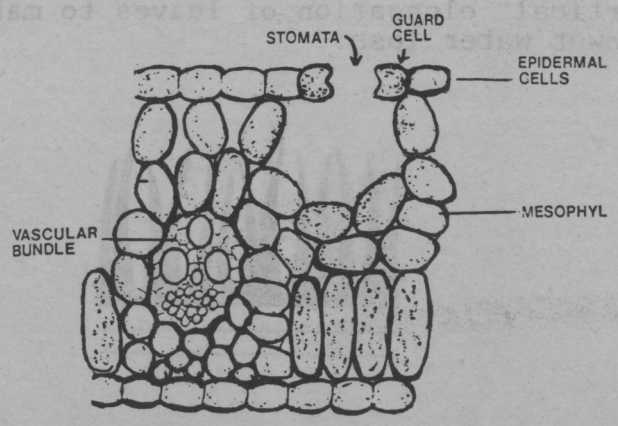
- Water use rates of turfgrasses are not only related to drought tolerance but also to cultural practices that help develop deep extensive active root systems. Practices that help to redistribute roots are also important.

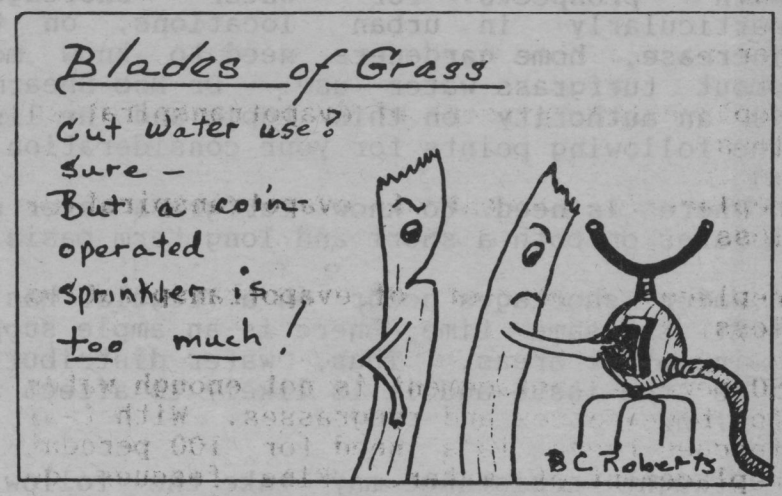
- It seems evident that if we are to reduce irrigation practices, something else must be done culturally to help turfgrasses persist. How can water be saved when the grass is made up of 80 to 90 percent water ?

- In Colorado, an evapotranspiration awareness program focuses attention on both soil loss and leaf loss of water.

- When there is less water in the air and more in the soil, water runs from soil to air through the plant.

- The structure of the leaf has an effect on loss of water. Various plant parts create resistance to loss of water.





- Water use rate increases when:
  - vegetative cover is greater and there is less bare soil, [soil evaporation also becomes less;
  - growth rate increases;
  - the growth season is longer;
  - there are conditions favorable for high evaporative demand.
- This evaporative demand is caused by:
  - high temperature;
  - low humidity;
  - air turbulence;
  - stimulated shoot growth;
  - reduced canopy resistance.
- What cultural practices have an influence:
  - mowing;
  - nutrition;
  - irrigation;
  - soil cultivation.
- Grasses differ in their tendency to wilt. For example: ryegrasses and bluegrasses use close to the same amount of water. Tall fescues use more water and fine fescues use less water. Zoysiagrass uses even less water.

Conference Topics

Cultural Practice Effects on Water Use Continued

- Chemicals effect the water use rate of turfgrasses. For example: plant growth regulators make grasses grow more slowly. The turf uses less water, but more water may be lost as the turf becomes more open. Tall fescues have deep roots and this is good even though they use more water. This high water use grass may stay green longer because of its deep roots. Ryegrass may also hold on longer than bluegrass because of having more roots.

  Watering practice may:

  - replace 100 percent of evapotranspiration loss;
  - replace 75 percent of evapotranspiration loss;
  - replace 50 percent of evapotranspiration loss.

  50 percent replacement is not enough water for bluegrasses and ryegrasses. With tall fescues there is a need for 100 percent replacement of water. Fine fescues do pretty well with 75 percent replacement of evapotranspiration water loss.

- Irrigation involves not only the quantity of water applied, but also the frequency. Standard recommendations call for deep infrequent watering. Recent studies involving evapotranspiration loss replacement of 100, 75, 50, 25, and 10 percent each at 2, 4, 7 and 14 day intervals showed that turf was better when irrigated frequently with less water.

- Dormancy of turf not irrigated is not the end. Bluegrasses will recover from dormancy in good shape.

- To make turf more resistant to drought:
  - raise the mowing height;
  - avoid spring and summer fertilization with nitrogen;
  - irrigate to replace evapotranspiration water loss depending on the needs of the grass.

- It looks as if we should be irrigating more frequently and only replace 75 percent of the evapotranspiration water lost.

LEARNING

According to a recent study by Stanford University, people learn:
- 10 % of what they hear,
- 30 % of what they hear and see,
- and 70 % of what they hear, see and write down.

According to that same study, regardless of source, we must use and put into practice that new insight 28 times before it becomes second nature to us.

Turfgrass Drought Avoidance and Tolerance

Dr Jeff Nus
Kansas State University

Recent developments in understanding water use by turfgrasses have led to considerations of how to avoid the effects of drought or at least make grasses more tolerant of water shortages. Dr Jeff Nus has conducted research to help shed more light on this topic. He suggests the following for your consideration.

- We must recognize difference between the terms drought and water stress. Drought is prolonged water stress. Some water stress is required for solute transport within turfgrasses. There are differences in water stress when it's light compared to when it's dark.

- Drought is affected by morphology of the turfgrasses. For example:

  - decreased growth;
  - decreased tillering;
  - thicker cuticle;
  - deeper rooting;
  - increased root to shoot ratio.

- In solution culture, polyethyleneglycol will produce stress that can affect the turf.

- Turf roots grow deeper and increase in quantity as soil dries from the top down.

- Turf roots are restricted in growth from:

  - too much nitrogen;
  - overwatering;
  - acid soil;
  - compacted soil.

- Drought resistance is noted as follows:

  - fine fescues — high
  - tall fescues — ↑
  - Kentucky bluegrasses
  - perennial ryegrasses
  - bentgrasses — low

  - bermudagrasses — high
  - buffalograss — ↑
  - zoysiagrasses
  - St Augustinegrasses
  - centipedegrasses — low

- Under drought conditions, turfgrasses may escape or avoid or tolerate detrimental effects.

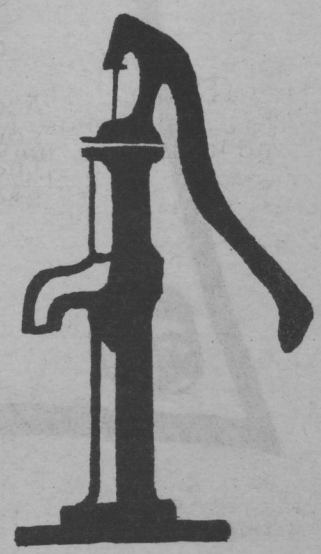
- Drought resistance may be defined in two ways. In an ecological sense, it means survival. In a production sense, it means growth.

- Water potential is a measure of the energy level of water. It determines the direction of water flow. Water potential exists in both plants and in soils.

- Water in soils may be classified within 3 ranges:
  - saturated soil;
  - field capacity soil;
  - permanent wilting soil.

- Water potential values vary from atmosphere to leaves to roots to soils.

- Ability of plants to maintain a high water potential is important. Special structures take up water and hang onto it. Xerophytic features include thick cuticles, extensive roots, efficient rooting, night time carbon fixing. Leaf structure varies in terms of numbers and location of stomates and guard cells. Osmotic adjustments keep these cells expanded.



Turfgrass Drought Avoidance and Tolerance Continued

- Drought avoidance involves the promotion of rooting. This is done by:

  - increase in height of cut;
  - aerification;
  - extra potassium.

- Greater rooting depth is more likely when:

  - temperatures are moderate at the soil surface where the crown is located;

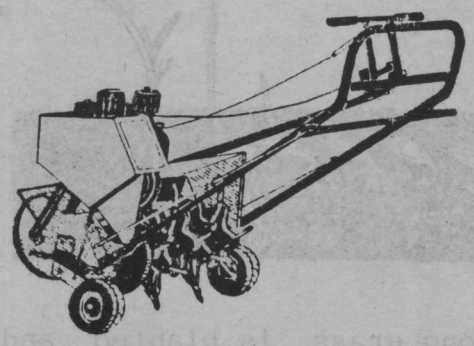
  - the canopy resistance is increased.

Compensatory growth may involve more leaves or more roots or less leaves or less roots.

Moderation of canopy temperature is realized when there is more shading where the crown is located. There is a difference in temperature from canopy surface to soil surface.

The canopy will help to reduce evaporation of moisture. This is referred to as canopy resistance. This may be realized as a short term effect or as a long term effect.

Aerification of the soil has an effect on these processes as oxygen diffusion is enhanced so that oxygen gets down deeper in the soil. This promotes root growth that influences canopy development.



- Drought tolerance involves the ability of turfgrasses to withstand the availability of less water. This may range from dehydration to osmotic adjustment under low water potential. Osmotic adjustment results from the ability of turfgrasses to concentrate certain substances:

  - sugars;
  - amino acids;
  - inorganic ions- potassium.

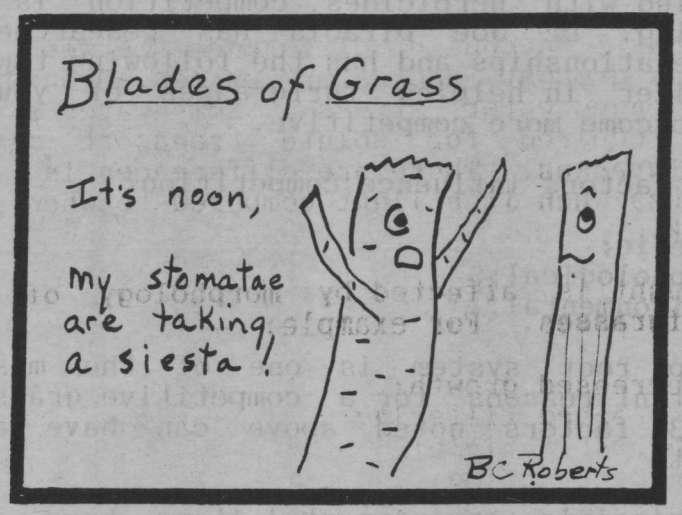
- Full turgor and insipient plasmolysis measurements are useful in the evaluation of osmotic adjustments. A moisture release curve can be calculated.

- Cell wall characteristics are also important in determining drought tolerance. Kentucky bluegrass can osmotically adjust to drought. In this way it retains water. Turgor mediates the process -

  - growth;
  - stomatal conductance;
  - activity of enzyme systems.

- All this is necessary to maintain growth:

  - keep stomates open;
  - maintain growth;
  - maintain cooling.



With stomates open, leaf temperature may be 85 degrees Fahrenheit. With stomates closed, leaf temperature may be over 100 degrees Fahrenheit. Stomates close rapidly when turfgrasses dry to a certain point.

- What effect will growth retardants have in these instances ? Plant growth regulators may make root growth greater. Energy for leaf and seed production should go to the roots. However, when leaf growth is slowed down, will there be adequate translocation to roots ? Timing is likely to be important, if roots are to be benefited. Plant growth regulators are known to be dependent on time of application for favorable results.

- Limit, Cutless and Embark applied in June produced a reduction in turf quality and no reduction in over-all water use. Turf was actually less dense when treated than when not treated.

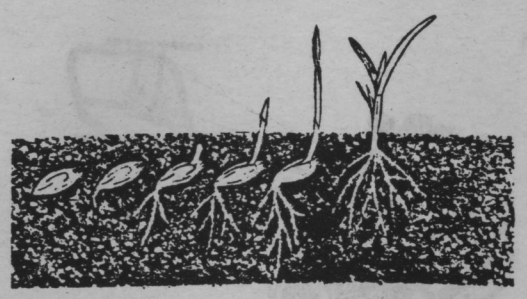
UNDERSTANDING TURFGRASS COMPETITION

Dr Joseph M DiPaola
North Carolina State University

Turfgrass competition is inevitable. Competition determines which plant or plants in a lawn will survive. When desirable grasses are more competitive than undesirable types, or when this competition weakens undesirable types so that they are more easily controlled with herbicides, competition is a good thing. Dr Joe DiPaola has researched these relationships and has the following tips to consider in helping turfgrasses of your choice become more competitive.

- Three factors influence competition:
  - genetic;
  - morphological;
  - environmental.
- A deep root system is one of the most important reasons for a competitive grass. All 3 factors noted above can have an effect.
- Six principle environmental items have an influence on competition:
  - light;
  - water;
  - nutrients;
  - carbon dioxide;
  - oxygen;
  - space.
- Weed encroachment can be serious because it takes space away.
- Look at these 6 items as a bank account. Gradually use some of each but still have some left. It's desirable to have a full account; to be an ample or even excessive provider. This takes a sharp turf manager.

- For example, the turf type tall fescues have deep roots. This amounts to a full account but these grasses use water at a faster rate. This latter condition lessens the value of the deep roots. The account is not as full as it might seem.
- There are 3 types of competition:
  - cultivar to cultivar;
  - species;
  - turf and weed.
- Early establishment competition is influenced by germination rate and seedling vigor.
- Mulch helps to conserve water and leads to a faster establishment. Without mulch, crabgrass may get started.
- With different species, there is a range in germination rates. Those that germinate rapidly will crowd out those that are slow to germinate.



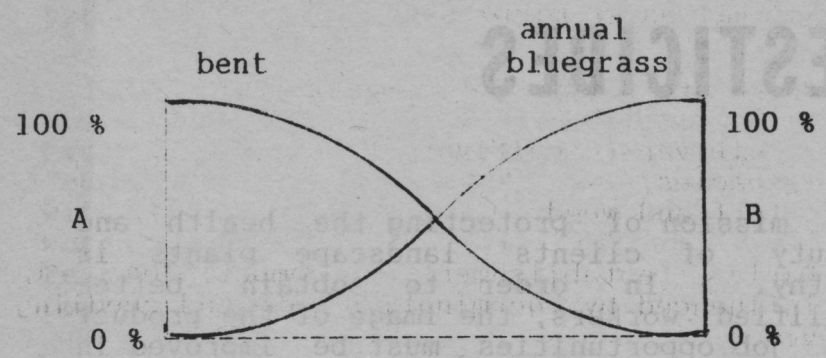
- If the wrong grass is planted and becomes established and then is lost, what of value will there be to take its place.
- With a slit seeder that puts in a new type of grass within an existing stand, the competition is usually keen.
- Seeding rates become very important. There must be enough seedling plants but not too many.
- Also, there is a balance between new and senescing shoots. Grass plants today are not the same as those that were there a month ago. Turf is composed of perennial plants that constantly rejuvenate themselves. Older yellowing sheaths are visible within the sod most all the time.

UNDERSTANDING TURFGRASS COMPETITION CONT

- The environment changes from full sun to deep shade and on into a microenvironment that consists of different temperature and moisture relationships down within the sod.

- A mature turf in a specific setting may be lush or it may be sparce.

- Where there is a two component competitive relationship there is always a balance ranging from 100 percent to 0 percent for each entry. Consider bentgrass and annual bluegrass.



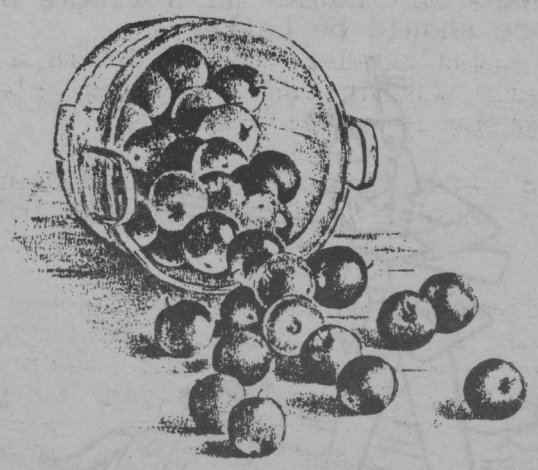
When one goes up, the other goes down. The turf manager has or should have control of conditions that create either situation "A" or "B" or something in between.

- Look for competition under stress conditions such as shade.

- Often mixtures of grasses make better turf because of competition.

- On the other hand, tall fescues clump when there are larger proportions of other grasses. With 80 to 90 percent tall fescue, there is less chance of competition from other grasses and the tall fescue looks better.

- Effects of competition are more obvious in a polystand than in a monostand.

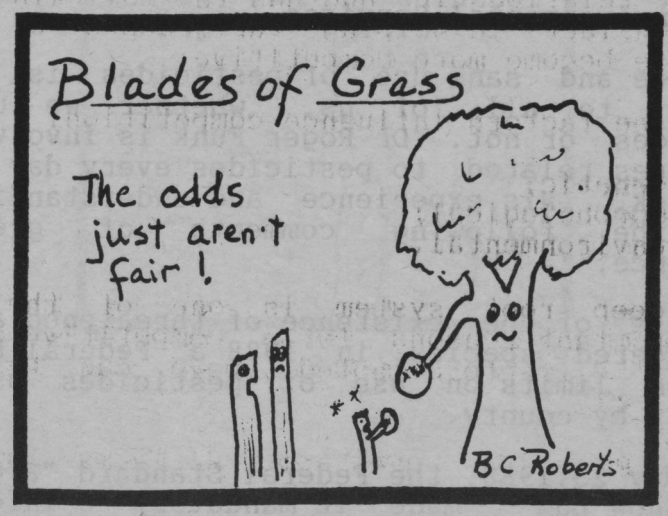


- In a mixed turf, there are advantages from genetic diversity and from adaptive potential.

- Plants that are comparable have similar:

  - vertical shoot growth rate;
  - leaf area;
  - leaf orientation;
  - crown location;
  - rooting;
  - growth habit;
  - nutrient uptake;
  - allelopathy.

- Allelopathy can create problems around trees. A 2 to 4 foot clear area around trees will help reduce the need for woody ornamentals and grasses to compete in this area. The effect of shade and roots in this area is bad enough without having to deal with allelopathy too.



- Growth regulation of turfgrasses may so reduce their competitive relationships that crabgrass can come in.

- A typical turfgrass may be cultured to receive:

  - frequent mowing;
  - low cutting height;
  - high fertility;
  - high traffic.

At times when the turf cannot take this, what is left to come in ? On some golf greens, take out annual bluegrass all at once and what is left ? Open space. Try to get the bentgrass to come back by increasing irrigation frequency and the annual bluegrass will come back again.

- Turf managers know that plant establishment has a lasting impact and that favoring basic grasses at the expense of all others results in high quality turf.

THE GREEN TEAM SECOND ANNUAL JOINT CONFERENCE
AND TRADE SHOW

Sponsored by PGMS and ALCA

Arlington, Virginia
November 7-11,1987

SAFE AND SANE USE OF PESTICIDES

Dr Roger Funk
Davey Environmental Services

The safe and sane use of pesticides is of concern to all of us, whether we use pesticides or not. Dr Roger Funk is involved in issues related to pesticides every day of the week. His experience and understanding make the following comments of great importance.

- Because of the existence of threatened and endangered species, in 1988 a Federal Law placed limits on use of pesticides used county by county.

- On May 23,1988, the Federal Standard "Right to Know Law" made it mandatory to inform workers and communities of practices and materials that might influence their health and welfare day to day. This was designed to cover all existing state laws that might be less stringent. For example: New York State requires a supervisor who is certified. Some states require that all applicators be certified. This requires some 30 hours of training for those that apply pesticides.

- There are many other regulations:

  * Departments of Transportation have regulations on the transport of chemicals, including pesticides.

  * Environmental Protection Agency [EPA] has regulations.

  * Occupational Safety and Health Administration [OSHA] has regulations.

- Regardless of regulations, there is a lack of competent workers and great difficulty in getting them on the job. Thus, implementation of regulations is difficult.

- The mission of protecting the health and beauty of clients' landscape plants is worthy. In order to obtain better qualified workers, the image of the product and job opportunities must be improved in the schools.

- When it comes to use of pesticides, all people seem to think they are experts. They each have the correct perception of the problem. It is either crisis or opportunity. How do you view it ? How do you handle it ? As a crisis or as an opportunity ? There is perhaps a need for change in perceptions within the industry. Why should there be this controversy ?

- There seems to be 3 reasons for the current pesticide crisis:

  * The media have and continue to condition the public to expect crisis;

  * Pesticide use out-of-doors is highly visible;

  * There is an over-emphasis on and over-use of pesticides. The shot-gun approach is common. Put on a lot of stuff whether it's needed or not. If a little bit is good, more should be better.

SAFE AND SANE USE OF PESTICIDES CONTINUED

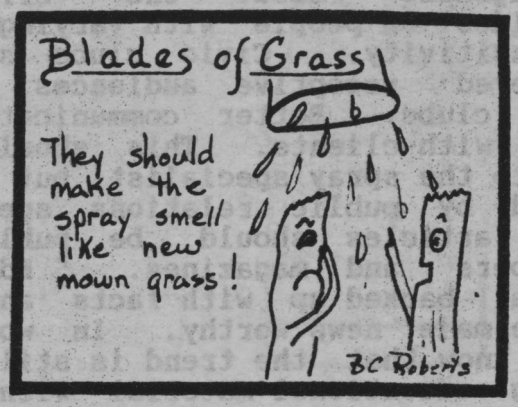
- Media conditioning is a major factor. The Monsanto trial lasted 3 years and 8 months resulting in tremendous media exposure. A tank of 19,000 gallons of industrial chemical spilled. One teaspoon full of dioxin in this spill resulted in 62 million dollars in punitive damage. The public essentially had no knowledge about this but the media got to dioxin - one of 76 compounds that is dangerous. The public perceived a crisis.

- Media conditioning is like feeding a dog every time a bell rings. The words "chemical" and "pesticide" are associated with hazard or danger. Every time these words are used, it's like ringing a bell - Fear is developed on the part of the public. Now, this may be true or valid, or it may not. The public has no way of knowing because the story is often flavored or altered by the media. Why else would you purchase a paper or watch TV ?

- The media is in the business of selling news. They do not have to give a balanced view of complex issues. They have to get something out that the public recognizes as newsworthy. Injury to someone or something is ideal for reporting. The news media do not do this intentionally. It's done to sell a product - news to a consumer willing to pay.

- Safe use of pesticides is not newsworthy. Some other slant must be developed to make this topic news.

- The media have made an issue out of the Lawn Care Industry. It's not difficult to take huge tank trucks filled with liquid and this sprayed on lawns with a distinctive odor to make the public feel they are being poisoned. This is true, especially when you know nothing about the contents of the truck except that the spray leaves fumes that you can smell. This means the active ingredient must be volatile and must be of danger to all in the neighborhood. In fact, the active ingredient cannot be very volatile or it would not be able to be effective on weeds, insects or diseases. The potential for misunderstanding is large.

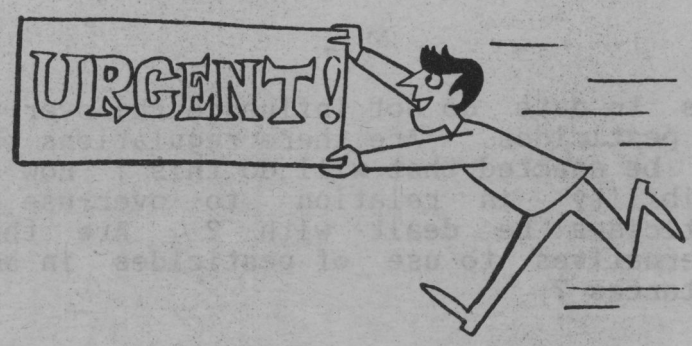


- Now, what can we do to improve understanding about safe and sane use of pesticides ?

  * First, take advantage of the controversy - to get exposure for technically accurate information. Change the negative presentation to the positive. Now this will be newsworthy - a form of free publicity.

  * Second, counter media conditioning. They have the initial perspective that is newsworthy. What do we have ? A new approach must be presented.

- This new approach involves - the dose makes the poison:



SAFE AND SANE USE OF PESTICIDES CONTINUED

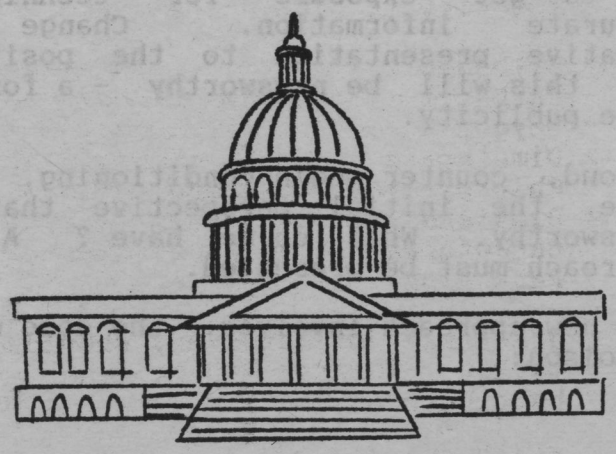
* Potatoes contain poisons that help the plants repel insects. Some selections contain so much poison and are so insect resistant that we cannot use them for food.

* Over consume almost anything and the total poison buildup can be harmful.

* Use of small amounts of pesticides pose little risk. Where pesticides are over-used, the risk increases. There is no question that the use of pesticides must be reduced but never eliminated.

- There is increasing need to be knowledgeable about the effects of pesticides on people with varying degrees of sensitivity. Civic clubs should be considered receptive audiences. Also, garden clubs. Better communications are needed with clients. This should not be left to the spray specialist, but should be handled by public relations specialists. Short articles should be published in newspapers and magazines. Educational material backed up with facts and figures can be made news worthy. In working on this, know that the trend is still that of backing educational material with hysteria as a means of attracting attention.

- There is a need to reach out to legislators to get the industry point of view out to them. They need to know the facts.



- Laws to date do not influence the over-use of pesticides. Are there regulations that can be enacted that will do this ? How can visibility in relation to over-use of pesticides be dealt with ? Are there alternatives to use of pesticides in some instances ?

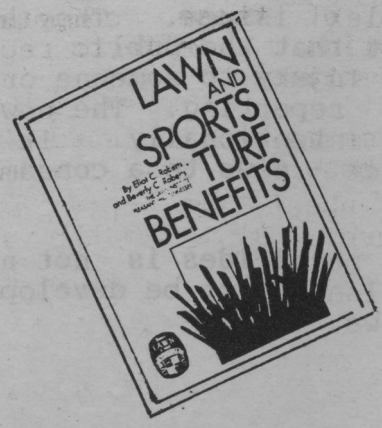
- At the present time, attempts are being made to increase the spectrum of materials that are available. Changes in the way business is conducted are being tried. Horticultural oils for woody plants, soaps and other materials are being tried. Some estimates indicate that a 50 to 75 percent reduction in petro-chemical use can be realized without loss of plants. If this can be brought about, there must not be higher cost for a lower degree of pest control. Citric oil, natural pyrethrums and rotenone are being screened alone and in combinations. Some reports show that pesticides can be reduced to 1/16 when use is combined with other products.

- Public perceptions of granular product applications being less toxic than liquid products may indicate that a combination of both should be used.

- At this time, we must get used to constant monitoring of all treatments and to keeping of detailed records. Applicators become exposed to pesticides - records must be kept. Investments in training the man with the gun are of great importance.

- The controversy should not be feared. Look for the opportunity rather than the crisis.

- The philosophy of customer care is a must. This is really lawn care with a service flair.



PESTICIDES:
PAST, PRESENT AND FUTURE

Dr Robert Everett Menzer
University of Maryland

As we consider alternatives to the use of pesticides, it is useful to look both in the past and on into the future in order to evaluate change in these chemicals that has taken place or is taking place. Dr Menzer has provided the following outline to help guide our thinking.

- Pesticides used "yesterday" -

* Chlorinated hydrocarbons: they are persistent; have a wide spectrum of activity; have a low acute toxicity; have a high chronic toxicity; and are inexpensive.

* DDT
* Toxaphene
* Lindane
* Chlordane
* Heptachlor
* Dieldrin

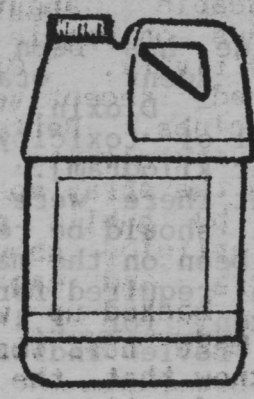
are all well known.

* DDT has accumulated in fish-eating birds to levels of 25 parts per million. this is a concentration increase of ten million times.

* DDT may start out in water with a concentration of 0.000003 parts per million or 3 parts per trillion. Zooplankton, living in the water, pick up 0.04 parts per million. Small fish live on the zooplankton and pick up 0.5 parts per million. Large fish eat small fish and they may contain 2 parts per million. Birds eat the larger fish and may accumulate 25 parts per million in their tissue. Other chlorinated hydrocarbons enter the food chain in the same way. Some of these compounds have cancer promoting effects under some circumstances.

* The media is confused concerning the use of these materials. With termites, these are about the only effective control measure. This is the final registered use.

* There is pressure on EPA from both sides. Data has not shown that these are carcinogens. They do not cause cancer. An arrangement has been worked out with Velsicol to change the method of application and continue to sell any Chlordane already in the market place. EPA has not banned Chlordane; it is still registered but is being withdrawn from the market.



- Pesticides used "today" -

* Organophosphates and carbamates are biodegradable. They have variable specificity and a high acute toxicity but a low chronic toxicity. Their cost is moderate to high.

* Orthene
* Carbaryl [Sevin]
* Baygon
* Dimethoate
* Chlorpyrifos [Dursban]
* Diazinon
* Carbofuran
* Parathion

are all familiar. They should last on the market longer than the chlorinated hydrocarbons.

* Aldicarb [Temik] is an insecticide that is soil incorporated. It is highly mobile, particularly in sandy soils, and has been found to be a contamination of drinking water. It is a potent insecticide and also harmful to mammals. It has a very high acute toxicity [LD-50 of 0.65 milligrams per kilogram]. People become sick from exposure but there is no major problem with cancer. Use has become restricted.

PESTICIDES: PAST, PRESENT AND FUTURE continued

- EPA has found many data gaps with these pesticides. Effects on ruminant metabolism represents an example. EPA procedure involves a data call-in. This means that more data on the chemical is needed and that those holding registration of the chemical must act. Special reviews may be called. This involves a review of all data - past and present. Questions are posed that are answered in a position document that is released. Registration standards may be reassessed. Methodology is checked. New testing or re-testing may be required. For example, this was considered for 2,4-D.

- 2,4-D herbicide has been linked in the media with Agent Orange and the contamination - Dioxin. 2,4-D has a moderate level of toxicity [LD-50 of 370 milligrams per kilogram]. A Kansas study suggested that there were dangers from use of 2,4-D that should be re-evaluated. The chemical has been on the market a long time and some data required for new chemicals was not taken for 2,4-D when first released. A review indicated no need for concern.

- Captan is a fungicide. It is very versatile; safe for plants and animals. It's acute toxicity is very low [LD-50 of 9,000 milligrams per kilogram.] Recently questions have been presented regarding reproductive effects, mutagenic effects and prospects for cancer in experimental animals but not in humans. A review of this chemical is likely.

- The present state of available compounds may be summarized as follows:

  * There are some problem areas because methodology has been improved since several old compounds were released. These need to be checked and new data presented.

  * Relationships between acute toxicity and long term toxicity need to be determined.

  * There is no question but what it is more difficult to register new compounds than it was the old ones.

- Pesticides for "tomorrow" -

  * Pyrethroids and insect growth regulators. These are like pyrethrums from the Chrysanthemum plant. They are biodegradable and specific. They have low acute toxicity and low chronic toxicity. Their cost is still not easily predictable.

  * Resmethrin
  * Fenvalerate [Pydrin]
  * Dimilin
  * Premethrin
  * Methoprene

  are becoming increasingly familiar. They work only on insects and have no effects on animals. These compounds disrupt the life cycles in the target organism. These life cycles are complicated and influenced by a series of hormones. There is a juvenile hormone and a molting hormone. The latter is difficult to deal with but the former is more likely to be synthesized. When this is accomplished, a disruption in the life cycle of the insect is brought about. These hormones are quite specific and do not affect anything else. To date, these compounds are so restricted in use that commercial companies cannot afford the research.

- Pesticides do not stay where they are put. biodegradation patterns are different. Thus, it is difficult to predict their fate in general terms. What alternatives are there to the use of pesticides ? There are two areas that should be considered:

  * IPM - Integrated Pest Management - use of climatic information, cultural practices and pesticides to produce the healthiest plants possible;

  * Biotechnology - genetic engineering to work towards development of gene transfer that will build plants with increasing resistance to insects and disease. In effect, the plants themselves will synthesize the insecticide or fungicide that will control specific organisms. At the present time there is great fear concerning this. When plants can do these things on their own, we lose control. We would not know what plants were doing in response to environmental changes. We might even lose the ultimate battle to the bug that comes in behind us. Also, there is potential in the development of bacteria that can produce a toxin that can be synthesized for plant protection. Pests could be controlled through use of these materials.

- There are relative differences in the effectiveness of compounds. For example, organophosphates are more effective than nicotine sulfate. And there is still much to learn.

Conference Topics

Warvests 15

PROFESSIONAL LAWN CARE ASSOCIATION OF AMERICA

8th Annual Conference and Show
San Antonio, Texas
November 12-15,1987

Shade Effects on Turf Care

Dr Arthur Bruneau
North Carolina State University

Shade creates conditions of low light intensity. Often this amount of light is inadequate to meet turf needs. Plants are weakened and may die. Dr Art Bruneau presents the following observations regarding growth of turfgrasses in the shade in North Carolina.

- Seventy five percent of the turf in North Carolina has to grow where there is some tree or other shade.
  - 21 % in heavy shade;
  - 40 % in moderate shade;
  - 39 % in light shade.
- Partial shade has a cooling effect on the turf.
- Light intensity effects are related to its duration and quality of light that passes.
- If there are not at least 4 hours of sunlight, use some other ground cover, not turfgrasses.
- In addition, there are soil moisture differences in open and shaded locations. These may be related to differences in temperature as well as to effects of roots from woody plants. Feeder roots are in the top 8 inches of the soil.
- Long shadows in fall and winter also are a type of shade.
- Leaf drop in the fall covers the soil and turf and thus produces a type of shade when the sun is low in the sky and days are shorter.

HOW MUCH HAPPENED YESTERDAY

When you add together all the activities Americans do in one day, the numbers can be surprising. For instance, each day:

- We eat 200 million pounds of fruit and vegetables
- We eat 1.2 million bushels of potatoes and 228,000 bushels of onions
- We pour 250 billion gallons of water through homes, factories and farms
- One new insect species is discovered
- Rats and mice damage $2.5 million worth of property
- About 200,000 tons of edible food are wasted
- We eat 50 million pounds of sugar
- Americans crush 85,000 bushels of cigarette butts
- Six million tons of manure are produced by farm animals
- We make 1.9 million sheets of plywood
- Aches and pains prompt us to ingest 575 bushels of pain reliever.

- Greensward
Vol X No 1

Turfgrass Nutrition Strategies

Dr James Beard
Texas A & M University

Turf and lawngrass nutrition can be complicated. In order to adequately meet plant needs, a combination of different strategies may be employed. Dr Jim Beard has devoted considerable time and effort to research in this area. Here he presents the following for your consideration.

- There are 9 major effects of nitrogen on turfgrasses:

  1 - shoot growth;
  2 - root growth;
  3 - shoot density;
  4 - color of foliage;
  5 - disease proneness;
  6 - heat, cold and drought hardiness;
  7 - wear tolerance;
  8 - recuperative potential and rate;
  9 - composition of the turfgrass community.

- Nitrogen rate of application should be limited to no more than one pound of nitrogen per 1000 square feet of water soluble types.

- The first response of nitrogen is on color of foliage. There are many gradations of green. The darkest green turf is not necessarily the most healthy.

- Nitrogen has an effect on disease. The application rate, the nitrogen carrier and application timing can either increase or decrease disease incidence.

- Under low nitrogen turf management, grasses are more prone to dollar spot, red thread and rust, for example.

- Use of the nitrogen carrier Oxamid has resulted in no brown patch on St Augustinegrass.

- Timing of nitrogen applications in the late fall have produced more snow mold.

- Look for nitrogen deficiency first by checking the tips of older leaves [the lower and outer leaves]. When they are pale green, this is the first indication. The yellow of these leaves will progress toward the base as deficiency intensifies.

- Nitrogen deficiency is encouraged by removal of clippings. As much as 2 pounds of nitrogen per 1000 square feet may be lost in a year.

- Coarse textured soils that are low in organic matter are prone to production of nitrogen deficient turf.

- Where there is intensive rainfall, nitrogen leaches away and the turf becomes nitrogen deficient.

- Phosphorus is not readily leached from the soil. At soil pH levels from 6 to 7, it is most available. In addition, turfgrass requirements for phosphorus are low.

- Phosphorus has 4 major effects on turfgrasses:

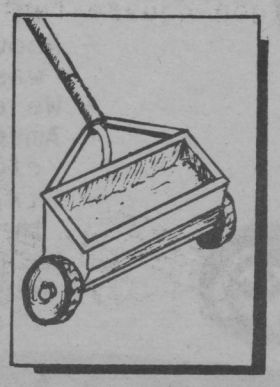
  1 - aids in establishment;
  2 - promotes rooting;
  3 - causes maturation of plants;
  4 - enhances seed production.

- When phosphorus is deficient, the foliage becomes darker green - a dull bluegreen. Older leaves exhibit this coloration first. Only a little phosphorus is required to correct this.

- Potassium is a good turf restorer. It affects rooting, drought, heat and cold hardiness, wear tolerance and disease proneness.

- With adequate potassium, there may be 1/3 more roots. More roots are observed under conditions of moisture stress.

- Hardiness is related to soil temperature [both hot and cold] and only indirectly to air temperature. Nitrogen to potassium balances are important in the promotion of turf hardiness - 2 to 1 or 3 to 2 [nitrogen to potassium]. This balance is needed year around.



Turfgrass Nutrition Strategies continued

- With more potassium, there is less wear damage on turf. Up to 3.6 pounds of potassium per 1000 square feet per year have been found beneficial.

- Addition of potassium has led to increased resistance of turf to brown patch, dollar spot and fusarium.

- Potassium is subject to luxury consumption by turfgrasses. High levels are not needed but grasses accumulate it anyway. After growth rates no longer increase with added potassium, these other hardiness benefits may continue to be noted. Natural concentrations of potassium in the soil are seldom adequate. These need to be increased for maintenance of healthy turf.

Sulfur was thought for years not to be a limiting factor in the growth of turfgrass.

- Sulfur availability is reduced at pH levels below 6. At that point the foliage looks like there is a nitrogen deficiency.

Iron is the most likely micro-nutrient to become deficient. Zinc and copper are heavy metals that do not move much in the soil. Higher than normal concentrations can lead to toxicity. Iron is required in very small amounts. At pH above 7, there is reduced availability.

- Iron is important for root and shoot growth for drought hardiness and for dark green foliage.

- Intervenal yellowing of the youngest leaves develops as iron becomes deficient.

- A foliar application of iron can produce a response in just 30 minutes.

- In turfgrass nutrition, nitrogen and potassium are the key.

- Nitrogen requirements of the turf are based on need indicators - pounds of nitrogen per growing month per 1000 square feet. Zero nitrogen is the lowest and the highest amount of nitrogen ranges from 0.5 to 1.5 pounds per 1000 square feet.

- The objective of turfgrass management is to grow grass and maintain the existing quality of turf.

- There are timing guidelines for use of nitrogen:
  - not during heat stress;
  - not during drought stress;
  - 30 to 40 days prior to winter where turf is subject to snow mold and winter kill, nitrogen should not be used;
  - watch for disease proneness;
  - watch for weed infestations.

- Use potassium in mid-summer where traffic is a problem.

- Use nitrogen after slicing and aerification.

- Use nitrogen after disease has run its course.

- Use phosphorus based on soil test results. Also, base potassium application on soil test results.

- Sixty five to eighty percent of the nitrogen applied may be matched 1 to 1 with potassium.

- Iron can function as a part of the nitrogen requirement by substituting it for nitrogen. Use iron at 2 ounces per 1000 square feet.

- From day 1 to day 5 following mowing, there is a 40 percent increase in the water use rate as leaves regrow.

- Eighty to ninety percent of the water lost by turf is through stomata. Most stomata close at mid-day and stay closed for a couple of hours. There is not as much foliar absorption of iron during this period.

TURF, PESTICIDES, AND GROUND WATER

Dr William Michael Sullivan
University of Rhode Island

The prospect that pesticides might get into ground water is a major cause for concern. Considerable speculation in this area has caused numerous "experts" to be quoted on this subject. Research conducted by Dr Mike Sullivan is helping to determine factors that may influence the mvoement of substances down through the soil. Here he presents some data from recent findings.

- Pesticide use increases all the time.

- Detection of pesticides in water increases. First it's in parts per million, then parts per billion and now parts per trillion. Pesticides are obviously pollutants in water. They should not be there.

- Pesticides have an effect on wildlife. These have been well publicized.

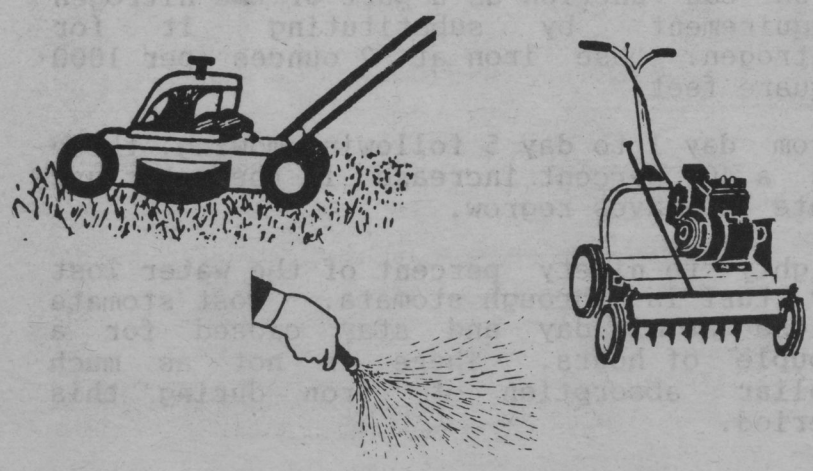
- There is a trend to classify all pesticides as the same. They are not the same; there are great differences between them. World-wide there are signals, such as:

  - poison;
  - danger;
  - warning;
  - caution.

  These are well understood. They can be used to help control pesticide pollution.

- Also several turfgrass cultural practices have an impact on pesticide movement, such as:

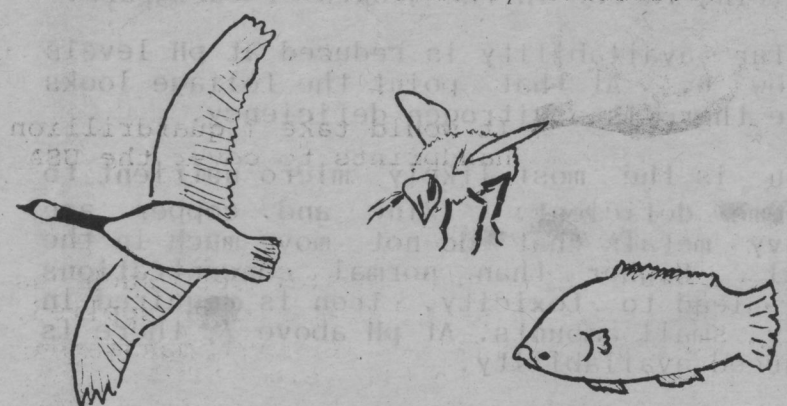
  - mowing;
  - watering;
  - thatch.



- Today pesticide trends are directed towards materials that are:

  - less toxic;
  - less persistant;
  - more soluble.

- Toxicity to non-target life forms is measured by LD-50. A comparison of LD-50 of 2 with one of 0.1 shows that there is a difference of 20 times between the two. Whether herbicide, insecticide or fungicide, this difference can have an effect on birds, bees or fish. This type of information is readily available.

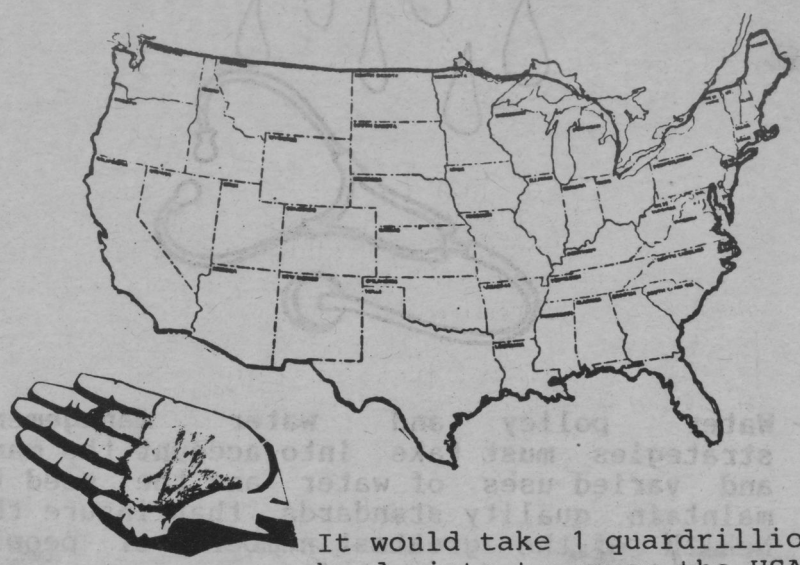


- Persistance of pesticides is measured in half-life, the length of time required for half of the material to be decomposed. Microbiological activity affects half life. Also, pH, temperature and soil texture [amount of clay], organic matter and water. Biodegradation is a natural phenonamon. Moisture and temperature increases speed up biodegradation. Materials that control weeds, insects and diseases must be active long enough to be effective, then biodegrade.

- Pesticides are applied in a water solution. They may end up in a sediment or in surface or ground water. Overland flow moves these materials in surface flow and perculation moves them into ground waters. "K" values can be calculated by dividing pesticide on the soil by pesticide in water. "K" values above 5 indicate that the material stays with the soil. Values below 5 indicate that material stays in the water. Low "K" value pesticides have an effect on ground water. This information is readily available.

TURF, PESTICIDES, AND GROUND WATER CONTINUED

- Analytical methodology is advancing more rapidly than our ability to explain the implications. Such small amounts of compounds can be detected that when found following application, the ramifications are often not certain.



It would take 1 quardrillion handprints to cover the USA

- When nutrients and herbicides such as nitrogen, 2,4-D and dicamba are applied, what are the losses ? How can management practices be related to this ? What are the effects of rate of application ? What are off site losses when turf is overwatered ?

- In tests at The University of Rhode Island there were only 3 runoff events in 3 years. Ground water in the test area was 12 feet below the surface.

- Nitrogen and herbicide movement was less than the prescribed limits of 25 parts per billion. 2,4-D was higher than dicamba which was no where near its limit of 12.5 parts per billion. When temperatures were cool and there was less microbial activity values were some higher. With more watering higher concentrations of 2,4-D and dicamba were found more frequently. Nitrogen has a very small "K" value when it is in the nitrate form. It stays in the water. Thus, the more watering the more nitrate moves. In these tests about half the federal advisory level was moved. Watering later in the year resulted in more loss of nitrogen as microbial activity decreased. Actually poor irrigation practices were more influencial than the amount of nitrogen applied when it came to loss.

- Thus, where should responsibility be placed for the contamination that has been found ? Actually "we have met the enemy and it is us" - both industry and the public. IPM should result in reduced pesiticide use. This is not likely to occur unless pesticide availability is reduced.

- Future pesticides are likely to be more mobile and less persistant. Our methodology will continue to outpace our ability to explain movement of pesticides. Irrigation practices will continue to be important. Thatch/soil relationships as related to length of time of thatch existance will determine how much pesticide stays in the thatch and how much moves through. Cation exchange sites on colloidal material will hold back movement of pesticides.

Trivia

PARTS PER BILLION

Picture 1 drop of water in an olympic sized swimming pool. That would be 1 part per billion.

1 ppb = 1 minute since the birth of Christ

1 ppb = 1 second in 32 years

1 ppb = 1 inch in 16,000 miles

1 ppb = selecting a 5 man basketball team from the Earth's entire population.

1 ppb = walking one-fourth of an inch of the distance between Augusta GA and San Francisco CA

Some chemicals [ex: dioxin] can be measured down to 1 part per quadrillion [one-millionth of one part per billion].

- Florrie Kohn
Solutions Feb 1989
[Vol 33,No 2] p 24-25

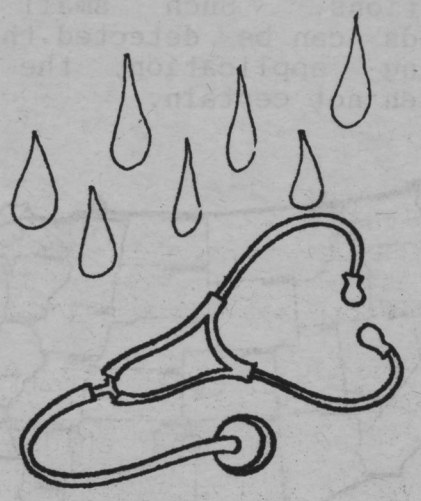
PESTICIDES, WATER QUALITY AND RUNOFF

Dr Thomas L Watschke
Pennsylvania State University

Research at Penn State University on water run-off from turf surfaces and on the quality of this run-off water has attracted international attention. Dr Tom Watschke advises that we not forget the following.

- At times turf pesticides may find their way into ground water. We should be aware of this possibility.

- So called "yellow journalism" has created a state of near hysteria in some locations as fear of environmental disaster increases.



- Water authorities and waste disposal authorities have responsibility for evaluation of local conditions in light of scientific research findings. Fact, not fiction, must be used in the interpretation of these findings.

- It's a fact that about 80 percent of the water we use comes from underground aquifers.

Major aquifers in the United States
—U.S. Water Resources Council

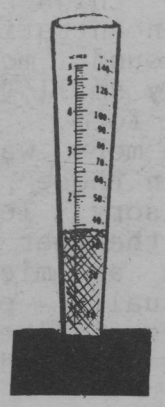
- Water policy and water management strategies must take into account the many and varied uses of water and the need to maintain quality standards that insure the health of the greatest numbers of people possible.

- Toxic puddles should not develop after a rain to cause harm to pets or children playing out of doors.

- Water run-off from non-pervious surfaces carries waste compounds and pollutants with it. Water drainage systems must keep this water from reaching underground aquifers.

- In Penn State, tests a 3 inch per hour irrigation device was not adequate to produce much run-off on well maintained turf. A 6 inch per hour irrigation was needed for run-off on sodded plots. Run-off water from turf was found to be less than expected.

- Remember there are about 27,000 gallons of water in one acre inch. This is a lot of water. With sod only 5 percent runs off. With an impervious surface 95 percent runs off.



An Epidemiologist's View on Lawn Care

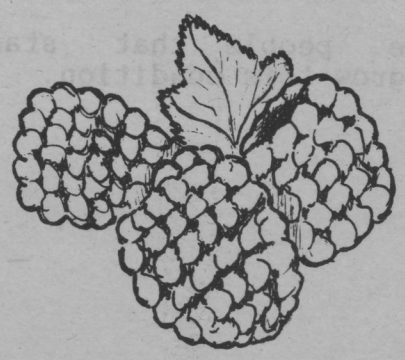
Dr Stanley H Schuman
Medical University of South Carolina

The perspective of the epidemiologist as related to pesticides used for lawn care is vital to a clear understanding of safe use of a wide variety of chemicals. Dr Stanley Schuman has recorded the following thoughts as a guide for discussion.

- Studies on birth defects tend to become complex. Animal studies on toxicology lead to studies on human births concerned with epidemiology. With animal defects, we can eliminate the animal [put it out of its misery]. We do not eliminate people with defects. We identify more defects with humans then we do with animals, in general.

- Toxicological data accumulates rapidly. We may draw conclusions on rats that have nothing to do with people. The appearance of truth in interpretation may be highly distorted.

- Raspberries, peppers, root beer, and peanut butter cannot pass safety tests. There are some 10,000 more carcinogens in the daily diet than in the environment around us. Food is a major source of harmful chemicals.



- Plants like marigold and chrysanthemums generate nature's own pest control chemicals. These will not pass safety tests. There are mutogens [from mutations] such as:
  - Teratogen
  - Carcinogen
  - Co-carcinogen
  - Oncogene

  that cause birth defects - chromosomal abnormalities. Defective ova and sperm may develop. There are intrauterine factors and hemolytic diseases.

- Envrionmental conditions that are considered health hazards include:
  - irradiation
  - drugs
  - alcohol
  - tobacco
  - viruses
  - heavy metals
  - plant toxins.

- With mutogens such as carcinogen it's a matter of luck or chance in early cell development. It's a chance that something can go wrong.

- What about pesticides and birth defects ?
  - 10 percent are caused by environmental conditions;
  - 25 percent are genetic or chromosomal related;
  - 65 percent remain unexplained.

  The 65 percent lend themselves to so-called witchcraft explanations and are fair game for legal action in the courts. For example, 4 percent of normal women will have a child with a birth defect. Five percent of agent orange exposed fathers will contribute to a birth defect in their off-spring.

Conference Topics

An Epidemiologist's View cont

- The media pick up enough information on these defects to arouse public concern. When one major defect or 3 minor defects are possible for every 100 live births, this touches pretty close to home. The importance of close survailance of birth defects is thus important. Monitoring began in 1970 with an early warning system under development. There were 13 million births in 1982 and 16.5 million births in 1987. Defects are identified in 160 clinical categories of which 33 are major or life threatening. Three - Downes, club foot and cleft lip - accouint for 25 percent of the total major forms.

- There have been no changes in birth defects attributed to increases in the use of pesticides.

- Nerual tube defects are particularly sensitive to environmental influences. Trends for this defect are decreasing internationally. Most trends for defects are flat, indicating no change. This one decreasing trend is never reported on the news. There is an information gap; that prevents material considered not newsworthy from being used.

- From 1970 to 1983 in the birth defects category, 22 were reported as stable or decreasing and 11 were described as increasing. Five of the eleven were cardiovascular - found to be increasing. This is likely the result of specialists working in this area with more data available. More accurate reports are likely when more specialists get involved. Thus, 6 of 11 were non-cardiovascular.

- Sylvex has been alleged to have caused problems, but the studies have been found flawed. 2,4,5-T has been given bad ratings and the media caught on to this right away. Regulatory services have had an influence. There has been much fear associated with myth in these instances. Such reports as "The Apolcolipities", "The Toxic Terror", and "The Coerciae Uptopians" have produced a vision of things going from bad to worse.

- Aging is the greatest threat to life at the present time. New information is providing better control of aging. With rats, one out of three die of old age. The age of cells is of critical importance.

- There are major limitations in measuring pesticides in ground water and to correlating this with human defects. Herbicides are often spingled out as most dangerous [more so than fungicides or insecticies] probably because of dioxin. Where the dollars go, the publicity goes along with the media. The public cannot see the forest for the trees. Only 1 percent of the people are sensitive to chemicals. Five percent of people have allergies or are sensitive to irritants such as:

  - sulfur
  - dust
  - poison ivy
  - pollon
  - certain plants.

Some people that start out allergic, outgrow this condition.

UPDATE BENEFITS

ALA Maintenance June 1989

A machine with cleats that can imitate the wear and tear of a football or baseball game is in use at the University of California, Riverside. A four year study shows that new perennial ryegrasses offer safety features important to football and baseball players. During the winter months, they provide a better cushion when bermudagrasses are dormant. The risk of injury to players is reduced with the better ground cover.

Although ryegrasses have been used to overseed playing fields in the southwest, new research shows that the new ryegrasses have advantages as a primary turf surface. Where turf is injured, it is easier to repair the field with perennial ryegrass. This improves attractiveness of the field and reduces player injuries.

Using perennial ryegrass as the primary turf cover would mean a higher mowing height, which, at first, would seem slower to the players who would soon get used to it.

"In 1984, the latest year for composite figures, there were more than 98,000 football-related injuries treated in hospital emergency rooms". Some of these were caused by field conditions. A Brinkman Traffic Simulator, invented by Stephen Cockerham, can identify the safest turf surfaces for athletics. "Cultural practices, such as mowing height and frequency, can have as much influence on wear tolerance as varieties within a species... The most important single factor in determining the wear tolerance of turf and shear strength is the biomass above the ground."

Subscriber News - Blue Cross, Blue Shield of Tennessee - 2nd quarter 1989

"Calories can be burned and muscles toned with many common chores". For example:

Task	Calories burned per hour
Digging	516
Mowing	458
Raking	222
Weeding	295

Note that mowing burns more calories/hr than the following sports:

Tennis	446
Aerobics	421
Bicycling [9.4 mph]	409
Badminton	396
Golf	348
Table tennis	276
Archery	264
Walking [3 mph]	228
Volleyball	204

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Lawn Institute Harvests is dedicated to improved communications among turfgrass seed and allied turf industries and other firms, businesses, organizations and individuals with lawngrass research and educational interest and concerns.

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