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Maintaining Wildlife Openings
OSHA and How It Affects the Turf Industry
Farmers at Bunker Hill
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Maintaining Wildlife Openings with Pellets Containing Pictoram

By Keith R. McCaffery and Fred Johnson
Wisconsin Department of Natural Resources, Rhinelander, and
Larry D. Martoglio, Forest Service—U.S.D.A.,
Nicolet National Forest, Rhinelander

ABSTRACT

Pellets containing picloram, the active ingredient in TORDON 10K pellets herbicide*, were used to selectively control unwanted woody vegetation in wildlife openings. The pellets were more convenient, economical, and effective than mechanical and liquid herbicide methods used previously. Ease of picloram application has greatly increased the scope of opening maintenance programs in Wisconsin. Broadcast application of picloram for wildlife purposes is not recommended because of the effect on desirable herbs and shrubs.

Forest openings in northern Wisconsin are important to the ecological and esthetic diversity of the forested environment and have a significant influence on the distribution and abundance of wildlife (McCaffery and Creed 1969). These upland openings are unique vegetative communities dominated by exotic grasses (Fig. 1). Most were created by historic logging, fires, and settlement. New sodded openings are not being created as a by-product of modern forest management. On the contrary, the acreage of sodded openings is decreasing as a result of tree planting and natural succession. Maintenance is imperative if openings are to remain for the benefit of wildlife.

The Wisconsin Department of Natural Resources (DNR) and the Nicolet National Forest began an openings maintenance program in 1968 using liquid herbicides (mainly 2,4-D and 2,4-DP ester as a foliar and basal spray) and mechanical treatment. The goal was to kill at least 75 percent of the unwanted woody vegetation in openings, and to insure that retreatment would not be necessary for at least 10 years. Because equipment used was cumbersome; costs were high; results were unpredictable; and incomplete kills and resprouting meant repeated treatments, a more efficient and effective maintenance method was needed.

Pelletized picloram (4-amino-3, 5, 6-tri-chloropicolinic acid) marketed as TORDON 10K Pellets herbicide appeared promising. TORDON 10K Pellets herbicides is a 10 percent acid formulation in an extruded clay pellet which has low dermal toxicity (Lynn 1965). It is not registered for cropland use, and is should not be used where it will wash into streams (Trichell, et al 1968).

Picloram kills most dicotyledonous plants, but toxicological studies indicate picloram has very low toxicity to fish, birds, mammals, and soil microorganisms (Tucker and Crabtree 1970, Kenaga 1969, Lynn 1965, McCollister and Leng 1969, Hardy 1966, Goring, et al 1967). We began a field test in 1971 using pellets containing picloram, and an operational maintenance program was underway by 1972.

METHODS

The field test was conducted on 20 openings on county-owned forest land in western Oneida County. The openings selected were typical of those occurring on medium to fine textured soils in northern Wisconsin (Levy 1965), and originated from an Indian settlement that was vacated in the late 1930s. The openings were 10 to 75 percent invaded by woody vegetation, mainly aspen, (Populus tremuloides), willows (Salix spp.), and chokecherry (Prunus virginiana).

Pellets containing picloram were applied by hand, a pinch (30-50 pellets) at a time, at the base of individual stems or suckers, and small handfuls were thrown over clumps of unwanted brush. Most vegetation treated was on the perimeter of the openings. A crew of two men — one walking on either side of the perimeter vegetation to be treated — provided the orientation necessary for full coverage.

(Continued on Page 4)
(Continued from Page 3)

Records were maintained on application rates, times of treatment, handling efficiency, travel cost, and man-hours required for treatment. The effectiveness of the field test was assessed with before-and-after photographs and by ocular estimates of mortality one and two years after treatment.

An operational maintenance program using picloram pellets was implemented on the American Legion State Forest during 1972, and on the Nicolet State Forest in 1973. Effectiveness of these treatments has not yet been evaluated; only costs of the operational programs are reported here, with costs of the treatments with picloram compared with costs incurred earlier using conventional maintenance methods.

### TABLE 1. Costs of maintaining forest openings with pellets containing picloram, liquid herbicide and mechanical treatment on DNR and Nicolet National Forest lands in 1972.

<table>
<thead>
<tr>
<th></th>
<th>Wisconsin DNR</th>
<th>Nicolet N. F.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Experimental</td>
<td>Operational</td>
</tr>
<tr>
<td>Labor</td>
<td>$ 54.00</td>
<td>$ 865.00</td>
</tr>
<tr>
<td>Travel</td>
<td>14.00</td>
<td>168.75</td>
</tr>
<tr>
<td>Chemicals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Picloram*</td>
<td>161.00</td>
<td>1,753.75</td>
</tr>
<tr>
<td>Liquid 2,4-DP</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Chainsaws</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Total Cost</td>
<td>$229.00</td>
<td>$2,787.50</td>
</tr>
<tr>
<td>Openings Treated</td>
<td>20</td>
<td>182</td>
</tr>
<tr>
<td>Acreage Treated</td>
<td>23.6</td>
<td>146</td>
</tr>
<tr>
<td>Av. Cost/Opening</td>
<td>$ 11.45</td>
<td>$ 15.32</td>
</tr>
<tr>
<td>Av. Cost/Acre</td>
<td>$ 9.70</td>
<td>$ 19.15</td>
</tr>
</tbody>
</table>

* The active ingredient in TORDON® 10K Pellets herbicide.

### TABLE 2. Comparative costs of opening maintenance using liquid and dry herbicide treatments on the Nicolet National Forest, 1972-73.

<table>
<thead>
<tr>
<th>Method</th>
<th>Openings Treated</th>
<th>Acreage of Openings</th>
<th>Total Costs</th>
<th>Cost per Opening</th>
<th>Cost per Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid — Mechanical</td>
<td>327</td>
<td>620</td>
<td>$11,817</td>
<td>$66.14</td>
<td>$(')19.06</td>
</tr>
<tr>
<td>Herbicide pellets</td>
<td>435</td>
<td>954</td>
<td>$12,793$1</td>
<td>$29.40</td>
<td>$13.41</td>
</tr>
<tr>
<td>Difference in treatment costs</td>
<td>$ 6.74</td>
<td>$ 5.65</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent savings in application costs</td>
<td>25.0</td>
<td>33.9</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Includes $5,206 for herbicide.

(Continued on Page 6)
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RESULTS AND DISCUSSION

Experimental Treatments

Eight experimental openings, ranging from 0.25 to 4.8 acres and averaging 1.75 acres, were treated on 16 September 1971 with 50 pounds of pellets for an average cost of less than $12 per opening. Despite the late date of application, satisfactory control of aspen, willow, fir (Abies balsamea) and alder (Alnus rugosa) was achieved. Cherries, (Prunus spp.), where treated, appeared to be the only woody plants of consequence that were not consistently killed, but at treatment time their leaves were already colored and dropping.

A second series of 12 openings, ranging from 0.25 to 3.5 acres and averaged 0.8 acres, was treated experimentally on 15 June 1972 with 90 pounds of pellets, for a total cost again of less than $12 per opening. The average cost, including travel, of treating all 20 openings was $229, or $11.45 per opening and $9.70 per acre of opening (Table 1).

Maximum rate of application was about 20 pounds of pellets (2 lb. a.e.) per acre, where we virtually recreated one opening that had been invaded by aspen, willow, and alder. The average rate of application was about 6 pounds of pellets per acre of opening. We recommended trained, well-disciplined crews for openings maintenance because the chemical is expensive and can be easily wasted by excessive application.

Costs of experimental treatments were lower than expected for an operational openings maintenance program because all experimental openings were reconnoitered prior to treatment, and were located within ¼ mile of road access. Costs would increase if treatment crews had difficulty finding or reaching openings.

Operational Treatments

The DNR began an operational opening maintenance program using pellets containing picloram in 1972. Pellets were applied in 182 openings, averaging 0.8 acres, for a total of 146 acres. About 10 openings were treated per day by a two-man crew; treatment costs totalled $2,788, or $15.32 per opening and $19.15 per acre (Table 1.) These costs averaged higher than the experimental treatments, reflecting logistical costs not encountered in experimental treatments, and a heavier rate of application (10.4 lb./acre vs 6.0 lb./acre). Most treated openings were in an advanced stage of succession.

In 1971-72, Nicolet National Forest personnel treated 498 openings (974 acres) mechanically and with liquid herbicide for $20,510. Costs averaged $41.09 per opening or $21.06 per acre (Table 1), and included some reconnaissance expense. Fewer than two openings per day were treated per two-man crew.

In 1973, 327 openings (620 acres) were treated for $36.14 per opening or $19.06 per acre, which was similar to the costs shown in Table 1.

Overall effectiveness of these treatments was judged to be fair to poor and retreatment will be necessary in most openings.

A comparison of relative costs of using liquid chemical vs. pellets containing picloram on the Micolet
National Forest indicated that pellets were significantly more efficient. Treatment of 435 openings (954 acres) on the Nicolet using Picloram pellets cost an average of $29.40 per opening or $13.41 per acre. Application costs were reduced 25 per cent per opening and 34 per cent per acre when pelleted herbicide was used (Table 2). Actual savings realized may exceed 50 per cent if the picloram treatments are as effective as in our experimental openings, and if the need for retreatments is reduced.

Treatment Results and Conclusions

Post-treatment examinations of the 20 experimental openings one and two years after treatment indicated satisfactory control of target species (Table 3). Picloram effectively killed aspen, willows and balsam fir—the most aggressive invaders of most forest openings.

Some translocation of chemical occurred in aspen root systems. Treatment of aspen suckers in the opening often resulted in death of parent trees on the forest edge, a phenomenon we viewed as advantageous to long-term opening maintenance. Two years after treatment, no new suckering of aspen or willow was evident in the openings.

Cherries and hazel (Corylus cornuta) were also common in openings and the adjacent forest. Though utilized by a wide variety of wildlife, these ubiquitous shrubs were treated whenever they threatened the opening community. Both genera appeared to be somewhat resistant to the chemical but we did not view this resistance as a problem, because neither is especially aggressive as an invader.

Non-target species were also affected where picloram was applied. Among the more abundant herbs killed in the demonstration openings were asters (mainly Aster ciliolatus), bracken fern (Pteridium aquilinum), goldenrods (Solidago spp.), Heal-all (Prunella vulgaris), clovers (Trifolium spp.), dogbane (Apocynum androsaemifolium), daisy-fleabane (Eriogon spp.), horsemint (Monarda fistulosa), yarrow (Achillea Millefolium), hawkweeds (Hieracium spp.) and strawberries (Fragaria spp.)

Two years after treatment, broadleaved herbs had not reinvaded the treated spots, possibly as a result of residual chemical, or the release and proliferation of bluegrass (mainly Poa pratensis). In either case, the effect is of little concern from the wildlife standpoint, because only a small portion of the total forest-opening surface receives direct application of picloram. However, as a result of the effect on non-target species, including many plants known to be important deer foods, we do not recommend broadcast application of (Continued on Page 8)

| TABLE 3. Ocular estimate or mortality by species in 20 experimental openings two years after treatment with pellets containing picloram.* |
|-----------------|-----------------|-----------------|
| Species         | Number of Observations¹ | Percent Mortality² |
| Northern hardwoods | 5                | 100              |
| Balsam Fir      | 3                | 93               |
| Aspen           | 23               | 91               |
| Alder           | 4                | 91               |
| Willows         | 15               | 87               |
| Hazel           | 6                | 74               |
| Chokecherry     | 13               | 71               |
| Gooseberry      | 4                | 50               |
| Blackberry      | 3                | 25               |
| Serviceberry    | 3                | 0                |

* The active ingredient in TORDON® 10K herbicide pellets.
¹ Number of openings containing species, or number of clones treated.
² Average mortality estimate from all observations.
pellets containing picloram for maintaining wildlife openings.

Picloram persistence in our soils was of some concern. Persistence is influenced by soil organisms, organic composition, moisture content, temperature, and the initial amount of herbicide (Youngson, et al 1967, Merkle et al 1967, Grover 1967). However, work by Goring, et al (1965) and Hamaker, et al (1967) indicates that at our application rates (about 0.6 to 1.0 pounds a.e. per acre of opening) picloram will dissipate to less than 0.01 ounce within about 2 years. Picloram is dissipated by photolytic degradation, leaching microbial decomposition, and dilution (Merkle, et al 1967, Youngson, et al 1967, Hall et al 1968, Haas, et al 1971). To date, there has been no documentation of a cumulative effect in the environment.

SUMMARY

We found the use of pelletized picloram for maintaining wildlife openings to be superior to liquid chemicals and mechanical methods; pellets were more convenient and safer to handle, significant cost economies were realized, effectiveness of control was excellent, and the pellets could be applied throughout the summer.

Plant mortality occurred sooner when picloram was applied during the growing season, but good results were achieved even as plants approached dormancy. Handling ease greatly influenced the implementation and magnitude of opening maintenance programs. Broadcast application of picloram for wildlife purposes is not recommended because of the cost and effect on desirable herbs and shrubs.

LITERATURE CITED


FIGURE 3. Deer use openings most intensively during spring and fall. Grasses and evergreen herbs are important foods before leafout in the spring and after frost in autumn.
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OSHA and How It Affects the Turf Industry

By Randolph W. Smith
Sales Engineer
Jacobsen Manufacturing Co.

Many of you have heard much about OSHA, but probably few really know its effect on your industry. I do not pretend to be an expert on the subject although I would like to pass along information that has been given to me and hope that it may enlighten you.

OSHA stands for Occupational Safety and Health Act of 1970. There is no such thing as being OSHA approved. Do not be misled by such advertising. OSHA does not approve, authorize, or endorse products. The Federal Trade Commission has ruled that it is an unfair trade practice to misrepresent that products are approved or required by the United States Government.

It will be easier to explain if you understand some of the background organizations and their purposes before we go further into OSHA. The following organizations have set certain standards within a given area.

O.P.E.I. — Outdoor Power Equipment Institute
This is a volunteer group of mower manufacturers that organized for safety standards in the mower industry.

This group is concerned mainly with the riding and walking consumer or the homeowner type mowers. Member manufacturers that manufacture to these standards may use the O.P.E.I. label to certify their products meet these safety standards.

A.N.S.I. — American National Standards Institute
This group was organized to cover standards in many industries. Many of their codes and regulations have been adopted by states, cities, and towns. They have adopted the O.P.E.I. standards for mowers.

N.F.P.A. — National Fire Protection Association
This is a group of manufacturers that organized for fire protection standards and codes. Insurance companies and many industries have adopted these codes.

Now when the Williams-Steiger Occupational Safety and Health Act was passed by Congress it was made a law in only 120 days. June 1, 1970. This act was not rushed into, because as early as 1948 members of Congress started to work on it. It took 22 years of hard work and many pro's and con's before its finalization in March 1970.

Congress took A.N.S.I. and N.F.P.A. standards and codes for their basics which were developed into the final Act of 1750 manuscript pages. Many of these regulations, codes and standards were devised over the years in various industries by well meaning, knowledgeable people. The consensus was that these were good solid safe practices, but many were never meant to become law as such although by passing the Act they did. Many people have done a thorough job of insuring safety, such as building codes, insurance codes, etc., but there are others which could not care less about his fellow men. The Federal Government had to insue the minimum precautions be taken for safety regulations. OSHA law effects everyone in commerce and is under the control of the Department of Labor headed by the Secretary of Labor.
The law contains provision that the Department of Labor is required to set and develop standards for:
1. Areas that no employee dealing with toxic material or harmful agents will suffer impairment.
2. Development and prescriptions of labels, or forms of warning, so that all the health hazards to which they are exposed.
3. Prescription of suitable protective equipment.
4. Monitoring or measuring of employee exposure to hazards.
5. Prescription of the type and frequency of medical examinations or other tests for employees exposed to health hazards.

There have been over 100 revisions made in 1972. Areas that have been under study for solid standards are:
1. Noise levels
2. Various chemicals
3. Fire proofing material
4. Carbon monoxide

Industries that have been key targets of the Department of Labor thus far:
1. Marine industry
2. Construction industry
3. Meat industry
4. Transportation field
5. Lumber industry

Let’s look at the turf industry.

Each golf course must keep certain records and be prepared to submit them on demand. Records must be maintained of the following:
1. Work related deaths
2. Work related injuries
3. Illnesses

Minor injuries requiring only first aid need not be reported, but a record must be made if they involve:
1. Medical treatment
2. Loss of consciousness
3. Restriction of work
4. Transfer to another job

The necessary forms required of each employer include:
1. A diary or log of all reportable injuries and illnesses. O.S.H.A. #100
2. A detailed report of all death or serious injuries or sickness due to work. O.S.H.A. #101
   Death should be reported within 48 hours to Secretary of Labor on Workmans Compensation Form.
3. An annual review of all reportable deaths, injuries and illnesses on O.S.H.A. #102.
4. A statistical report to the Secretary of Labor of all work injuries and illnesses of which records are required. Only on request.

Inspection:
1. Any employee who believes that a violation of safety or health standards exists may request an inspection by sending a signed, written notice to the Department of Labor. A copy of the complaint (Continued on Page 12)
must be furnished to the employer, but the name need not be supplied.

2. A death or serious casualty will result with an inspection.

3. Spot check inspection —
   The O.S.H.A. inspection teams have made 75,000 inspections. Approximately 1 out of every 4 have been o.k.'d. The balance of some 40,000 inspections have carried fines that have amounted to over $3,500,000.00.

During an inspection, the employer and a representative of the employees are permitted to accompany the inspector during any physical inspection. The agency has ruled, however, the inspectors do not have to allow union representatives to accompany them on a tour of the plant or golf course and equipment.

Although the law states “each employer shall comply with occupational safety and health standards” there is no disciplinary action against an employee who refuses to comply, such as firing, transfer of job. In short, the responsibility for enforcement of the employees is placed with the employer. It’s the employer that must see to it that the employees read the rules and standards, understand them and carry them out.

The main impact on the Turf Industry will center on the maintenance shop, maintenance equipment, and the proper safety equipment for the employees.

1. Maintenance shop will be same as any other plant.
   It must have:
   A. Fire extinguishers properly marked
   B. Washroom—hot and cold water
      male/female—not used for eating
   C. Building clean as to fire material and aisles out
   D. Proper lighting—basement and balcony stairs
   E. Spray paint room—don’t paint inside
   F. Grinding room
   G. Shop tools—guards, grounded, etc.
   H. Safety equipment—safety glasses, goggles, gloves, etc., hard hats
   I. First aid kits handy
   J. Inside gasoline storage
   K. Strong—stairs, balconies, railings, etc.
   L. Exit signs—(lighted)

2. Maintenance equipment in specific pieces of equipment. Per. A.N.S.I.
   A. Walking machines
      Controls—forward-forward
      reverse-back
   B. Riding machines
      1. Controls
      2. Brakes
      3. Deadman Controls—neutral control
      4. Starting arrangement—neutral
      5. Stability requirements
      6. Warning and safety instructions
   C. Rotary units
      1. Proper toe guard—walking unit
      2. Discharge extension
      3. Blade speed
      4. Blade stopping time
      5. Discharge angle
      6. Catcher strength
   D. R.O.P.S.—Roll Over Protection Structure required of all agricultural or industry tractors that are equipped with blades, back-hoes, trenchers and lifts.

As to turf—tractors are not required at present to have R.O.P.S. except in California. This will be changed, we believe.

Those who are interested in knowing more about O.S.H.A., (and I believe each and every one of you should be) may obtain a copy of the Law by:
   1. Writing the U.S. Printing Office—Washington, D.C.
   2. Going to the Federal Library or Book Store and buying a copy.

Maybe best of all, I would suggest to those of you that will buy new equipment in the coming year to check and see that proper guards, etc., are on the equipment and will meet O.S.H.A. standards if you have an O.S.H.A. inspection.

Farmers at Bunker Hill

This month marks the bicentennial of the first pitched battle of Revolution

It was just 200 years this month that a band of New England farmers left their plows in the fields to take up arms in a fight for freedom from British colonial rule. June 17, 1775, was the date when the Battle of Bunker Hill was fought. (Actually, the battle was fought on Breed's Hill, adjacent to Bunker Hill, in Charlestown, across the river from Boston.)

Not all of the patriots who fought the Battle of Bunker Hill were farmers, of course. There were merchants from Boston and other metropolitan centers; there were doctors and silversmiths, and representatives of other professions. But the vast majority of the colonials who fought at Breed's Hill that fateful day were farmers because the majority of citizens of all the colonies were farmers.

As so often happens in such disputes, there was no intention of starting a full-scale war atop the heights of Charlestown. General William Howe, in command of the British forces in Boston, had drawn up a battle plan which, he hoped, would break the siege the colonials had thrown around the city. The 15,000 besiegers were encamped in an irregular nine-mile semicircle which ran from Roxbury on the south, through Cambridge in the center, to Medford on the north. Cambridge was the headquarters of the American army as well as the depot for its scanty supplies of ammunition and food. Although outnumbered five to one, Howe intended to launch a daring attack on this nerve center. The assault was to begin on Sunday, June 18. Under the covering guns of the British fleet, Howe was to lead a brigade of 1,500 men in an amphibious landing on Dorchester Point. From there he would move rapidly to secure the heights on this narrow peninsula which looked down upon Boston from the south, then move swiftly out to smash the flimsy American defenses at Roxbury.

Meanwhile, Major General Henry Clinton was to launch another attack from boats, landing opposite the American center at Cambridge. Leaving a few hundred men to protect his flank at Roxbury, Howe planned to sweep around Back Bay with the rest of his brigade, while General Clinton was securing the heights above Charlestown. He would then lead the combined brigades against the center of the American army in Cambridge.

Here the colonists would have to commit their raw troops on open fields where Howe was confident his superbly disciplined regulars would roar through them like a juggernaut. With their ranks decimated, their stores and ammunition destroyed, the whole makeshift American army would evaporate into the woods and back to the farms from whence it came. The siege of Boston would be over, the armed rebellion would be shattered.

It was General Clinton who, late on that fateful night, reported to Howe that the Americans were entrenching on Charlestown Heights, the number involved undetermined. Clinton told Howe he had advised General Thomas Gage, governor of Massachusetts, that the British should prepare for a landing at dawn, close to the neck of the land, and take the Americans. Gage counseled delay until the size of the American force had been determined. Howe agreed with Gage, so he decided to wait. That proved to be a serious mistake. The Americans had an opportunity to dig in, throwing up breastworks and creating redoubts.

(Continued on Page 14)
When the British did finally attack on Saturday, June 17, they were met with withering fire. Historians have said that the 15 minutes of the first attack in a field of unmown hay was "one of the most ghastly frontal attacks in the history of warfare." The results were written in blood; 44 out of 49 officers were killed by the murderous blasts from the guns of the New Hampshire and Connecticut farmers who had heeded Col. William Prescott’s advice to "hold your fire until you see the whites of their eyes."

The British retreated only to regroup and once more try to gain their objective of the rail fence across that hayfield behind which the Americans were positioned.

Again the British failed, but the third time they turned the tables on "the embattled farmers" and forced them to retreat.

Americans are used to Fourth of July orations on the glories of Bunker Hill. It is difficult to realize now that throughout the Revolution and for several decades thereafter, the fight was considered an ignominious defeat. But gradually it came to be recognized that the basic purpose of the battle had been actually realized beyond the Americans' greatest hope. The shocking British casualties utterly immobilized Gage and Howe. Many of Howe's contemporaries blamed his failure to win the Revolutionary War on his experience at Bunker Hill. There is considerable evidence to support the argument. Again and again, in the two years he was commander-in-chief, he failed to follow up smashing victories, or he let Washington slip away because he could not bring himself to send his men against the Americans when they were entrenched behind even the flimsiest walls.

The British may have won the battle, but they lost the war. And their final defeat actually began in their first battle victory. They never forgot the lesson of the sharp-shooting American farmers who blasted so many Redcoats out of existence at Bunker Hill.

Map shows disposition of opposing armies as the British attempted their first assault on Bunker (Breed's) Hill.
Sometimes it's better to hear it from someone else...

Here's what Berkley Carter of Tuckahoe Turf Farms, Slocum, R.I. has to say about

**baron**

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"When I need a herbicide, Baron can take the shocks better without streaks or setbacks. It is an aggressive grass needing only minimum maintenance practices."

"Baron comes up fast... that's important to me. I want to see fuzz in 7 days so that the soil is protected as soon as possible."

"It's hard enough getting the seedbed ready. I'm not going to spoil everything with a poor quality seed. I don't know why every sod grower doesn't use Baron."

"And your Jamestown Fescue is great too."

Jamestown is perfect for a bluegrass blend, particularly Baron. It has great eye appeal and when sod is needed for sun and shade areas Jamestown/Baron really go well together.

One more comment from Berkley... "When you've got a good thing going - stick with it."

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*Tuckahoe Turf Farms, growers of 600 acres of cultivated sod is one of the largest sod farms in New England.
Septic Systems — How Long Do They Last?

By David E. Hill and Charles R. Frink

Four out of 10 of Connecticut’s homeowners must dispose of sewage wastes on their own property because they live beyond sewers. Although sewers are being extended into many areas of moderate population density, the number of homeowners using septic systems is not likely to decline because development will occur in more remote areas.

If a septic system fails, causing sewage to back up into household fixtures or to erupt onto well-manicured lawns, it is an expensive annoyance. Local health officials become concerned because failing systems may jeopardize health. This concern enlarges if town and state officials must decide if centralized treatment is necessary.

Many questions are raised, but the foremost are:

- How long do septic systems last?
- Do the kinds of soils in which they are installed affect their life span?
- How effective are repairs of failing systems?
- What effect do changes in design have on performance?
- Does weather affect performance?
- How can systems be improved?

To answer these questions, the Experiment Station, with the help of five honors students from Glastonbury High School, surveyed all septic systems in the town.

To calculate the longevity of these systems we determined the date of initial use of all those in operation, and the date of repair for those that were repaired. We found the soil type on each lot by overlaying a transparent soil map on the town map showing lot boundaries, and we recorded the percolation test rates that had determined the design capacity of each leaching field. All data were transferred to punch cards for evaluation.

All systems were tabulated according to age and the calendar year when they began operating. Comparisons were made between systems that failed and those that succeeded. Although the records only went back to 1961, we were able to estimate statistically the number of systems constructed for our longevity predictions.

Many soil types are found in Glastonbury. The town straddles the boundary between the Connecticut River Lowlands with its dominantly sandy terrace soils, and the Eastern Highlands with its soils derived from glacial debris (till) covering bedrock. Since few systems were installed in many of the soil types, we combined soil types into five groups. These groups and their percent cumulative failure rates over a 20-year span are shown in the table. Overall, we found that 493 of 2,845 systems had failed since 1961. The table reveals that 6 percent of Glastonbury’s septic systems failed within 5 years, 11 percent failed within 10 years and so on. The half-life (the time it took for half of the systems to fail) was 27 years.

Looking at individual soil groups, only 3 percent of the systems installed in stratified sand and gravel failed within 5 years. In contrast, 12 percent of the systems installed in compact glacial till with hardpan at shallow depths failed early. Surprisingly, however, these systems had the longest half-life, 38 years. We attribute this to the fact that systems installed in compact till generally have larger design capacities than those installed in stratified sand and gravel because their slower percolation rates require larger leaching areas.

The records of early failures of systems installed in compact till showed that most of the percolation tests and site evaluations had taken place in summer and early fall when water that normally perches on top of the compacted till usually dries up. Thus, where failures occurred prematurely, the perched water tables were probably undetected. Further, percolation tests performed in dry soils have faster rates than those performed in the wet soils of early spring. Hence, the indicated size of the leaching field was often smaller than would normally be required. Repairs on half of these premature failures increased the size of the leaching field. The other half required ground water control. Only one in 31 of these repaired systems failed a second time.

The table also reveals a surprisingly short half-life for systems installed in loose glacial till. Their 23-year half-life is 15 years shorter than for systems installed in compact till and 4 years shorter than for systems installed in stratified sand and gravel. To determine the probable cause we compared the percolation rates of systems installed in two of these soil groups. Fully 95 percent of the percolation tests for systems installed in stratified sand and gravel had fast rates that allowed the smallest leaching area. Over 80 percent of those installed in loose glacial till also had fast rates.

The distribution of soil particle sizes and the pore spaces between them probably explain the difference in long-term performance. Stratified sand and gravel has little silt and clay, and large pores predominate. Loose glacial till, although quite sandy, include a mixture of silt and clay with fewer large pores. Silt and clay may become smeared on the exposed surface of leaching trenches, beds, and pits during excavation, especially if the soil is wet. This smearing of silt and clay shortens the life of the system by reducing the infiltrative capacity of the soil.

**EFFECTIVENESS OF REPAIRS.** Analysis of our data showed that of the 493 systems repaired, 24 failed a second time within the last 13 years. Treating the 493 initial repairs as a new population, we found the projected half-life of a
repaired system to be 21 years. Thus, repairs that correct design and installation deficiencies or poor management by the homeowner add measurably to the life of a system.

DESIGN CHANGES. The design requirements for leaching area were essentially tripled in 1961. In an attempt to evaluate the effectiveness of this change, we divided the septic systems into two age groups. Systems installed in compact glacial till between 1944 and 1961 failed more slowly than the average, but after 1961 they failed more frequently than the average. As we have already indicated, the rate of early failure is high for systems in compact glacial till. This may account for the apparent increase in the post-1961 failure rate. Systems installed in sand and gravel showed the greatest improvement and were the only group failing less than the average rate. For all soils, we observed about a 10 percent decrease in the rate of failure, but this difference was not statistically significant. Thus, we concluded that several more years are required before we can determine the full impact of the change in design requirements on the longevity of septic systems.

WEATHER. To examine the effect of weather, we looked at failure rates during the very dry years of 1965 and 1966, and the very wet year of 1972. The failure rates during 1965 and 1966 were similar to those of the normal weather years of 1964 and 1967. The failure rates in 1972 were the same as in normal year 1971. Hence, wet weather itself seems to have little direct effect on performance.

However, the effect of weather may be more subtle. We noted that systems initially used in 1956 had, by far, the highest number of failures. We found that most of these systems had been installed during the fall of 1955 when over 22 inches of rain fell during August and October. Conversely, we noted few failures in 1958 of systems installed during the exceptionally dry year of 1957.

Thus, the weather during installation seems to affect longevity more than the weather during use because systems installed in soils saturated with water are more prone to lose their capacity to transmit water early.

IMPROVEMENT IN PERFORMANCE. Our survey of Glastonbury's septic systems suggests several corrective measures to improve performance and increase longevity.

- Percolation testing in early spring when water tables are normally highest, especially in compact till. This should reduce premature failures due to drowning of leaching fields by perched water tables.
- Larger leaching fields for systems installed in loose glacial till. This should improve their longevity.
- Delay in installation and repair of systems until soils with appreciable silt and clay drain fully. This should minimize smearing.
- Leaching field sizes based on percolation tests, deep observations, and knowledge of soil type.

<table>
<thead>
<tr>
<th>Longevity of septic systems installed in different soil groups</th>
<th>Sample size</th>
<th>% Cumulative failure</th>
<th>Half-life* (Yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5-Yr</td>
<td>10-Yr</td>
<td>15-Yr</td>
</tr>
<tr>
<td>All soils</td>
<td>2,845</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>Stratified sand and gravel</td>
<td>1,608</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>Loose glacial till</td>
<td>491</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>Compact glacial till</td>
<td>278</td>
<td>12</td>
<td>16</td>
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<tr>
<td>Shallow to bedrock</td>
<td>333</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Poorly drained soils</td>
<td>129</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>Miscellaneous soils</td>
<td>6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*The number of years before 50% are expected to fail.

TURF BULLETIN

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—OVER 40 YEARS EXPERIENCE—
Domesticating Wildflowers for the Home Garden

More and more Colorado gardeners are undertaking the home care of their state’s native wildings. The movement demonstrates a remarkable shift in emphasis from the protection and preservation of wildings in their natural habitat to the personal cultivation and propagation of native plant species in the home garden. Leaders of the domestication concept believe that in this era of accelerated commercial development of the mountains with vacation and ski resorts, massive highway programs, and new strip mining projects, mere protection of the fragile native plants is not enough.

While shrubs and trees are being gathered in advance of commercial depredation by nursery specialists, and shrubs and herbaceous perennials are being collected by wilding fanciers. Always the necessary permission is obtained in advance from ranch owners, Forest Service officials, and highway and damsite engineers. In each case the fundamentals of conservation are observed. Collectors dig only where there is an adequate supply of the plant remaining and only when they are reasonably sure they will be successful in growing the plant they collect.

Ruth Nelson, Colorado wilding authority, advises new collectors to be judicious, to give the wildings plenty of sand and peat moss when transplanting. Collect them in small plastic bags during the cool of the day, and get them into the new ground as soon as possible. Then keep them moist and shaded until they show signs of new life. In her own foraging Mrs. Nelson tries to find small individual plants for transplanting because with small root systems the plants will suffer less damage in moving and will stand a better chance of survival.

The art of domesticating wild flowers is not a short cut or an economy move for the city gardener. Wildings take more time and more care than do commercially-grown stock, but they extend the scope of an in-town garden, introducing to high plains Coloradoans the beauties of thimbleberry shrubs, bush cinquefoil, white fir, and pinon pine. The home gardener can enjoy all manner of figwort from the tall pink-red penstemon, which the hummingbirds love, to the azure blue mountain beartongue, and the vivid scarlet Indian paintbrush. Such a garden becomes a living museum for students of montane, sub-alpine, and alpine native plants.

The pasqueflower is one of the most beautiful and conspicuous of spring flowers, appearing each year in early March, well-protected against late snows and cold winds by a coat of silky hairs. The delicate pink shooting star follows soon after, and then the dancing blue columbine. The intensity of the blue petals depends upon the shade and moisture of the situation.

The proud gardener boasts the cultivation of the Western Red Columbine, Aquilegia elegantula, tiny sister to the better-known eastern species.

Four to five foot mountain larkspur in full bloom beside a stand of moist aspen can impress the most sophisticated of home gardeners. The slender, vivid blue spikes seem far more exciting than the modern hybrid delphiniums many modern gardeners have graduated to. Too many of us forget that most of the hybrid beauties of today’s show gardens are the children of yesterday’s wildings. A visit to a wilding collector’s garden is a kind of refresher course for the forgetful.

Colorado wildflowers to be conserved include the blue, red, and alpine columbine, the mountain clematitis, the tulip and fringed gentian, all paint brush, the fairy and the yellow lady’s slipper orchids, the coral root, the Parry primrose, the pipsissewa, dwarf laurel, and wood nymph heaths, the glacier and the woodlily, and the birdfoot violet. In addition to the above, the list includes all ferns, all ball cacti, and all alpines.

Alpine flowers should not be collected; they have survived by adaptation to withstand the severe conditions of their area. They survive by cushion and mat formation. Some cushions are known to be several hundred years old. In addition to the harsh weather, they are subject to the inroads of four wheel vehicles, snowmobiles, and mountain climbers. But most of the alpines have extensive tap roots enabling them to live where top soils shift constantly. Big-rooted spring beauty may have a root six feet long and 1 to 3 inches in diameter. That is hardly a plant for transplanting. Collect a few seeds if you must.

One word of caution, avoid wildings that spread invasively. This includes most members of the pea family.
(golden banner and the locos), bracken fern, *Geranium fremontii*, and the star-flowered Solomon's seal. A good clue to the spreaders is generally evident where they are found. Those plants that take over an entire area, crowding out other plants, will be a nuisance in a home garden.

Shrubs worth growing include the birches and maple, the squaw-apple sumac, Apache plume, mountain mahogany, thimbleberry, red-twiggled dogwood, serviceberry, chokecherry, golden currant, and shrubby cinquefoil. Ground covers of value include mahonia or creeping holly grape, pussy toes (*Antennaria*), creeping phlox, kinnikinnik, low-growing erigerons (fleabanes), and stonecrop sedums.

Of the tall perennials, look for monarda, penstemon, asters, and the rudbeckia black-eyed susan. In a dry, near-desert location try yucca, the liatris gayfeather, rabbitbrush, prickly pear, and the ball, and green-flowered cacti.

Wilding fanciers never show their treasures in flower show competitions. However they encourage and promote educational exhibits of native plants in labeled specimens in water, potted in containers, dried specimens, or in color slides, as a way of fostering the preservation of these endangered species.

Massachusetts wildflower authority, Katherine Taylor, has long advocated the positive approach to wildflower conservation. For years she has maintained a large private wildflower sanctuary. She has said that a naturalistic garden is ideal for busy persons. A degree of shade is important, and high shade is generally ideal. To the eager new converts she has cautioned that wildflowers are not established until they are capable of reproducing themselves; otherwise they are merely visitors.

**Good places to view alpine flowers in Colorado:**

TRAIL out from the top of Hoosier Pass on State Highway 9 between Fairplay and Breckenridge.

TRAILS off Mt. Evans scenic highway, off I-70 above Georgetown. (M. Walter Pesman Trail on Mt. Goliath.)

(Continued on Page 20)
TRAILS off Pikes Peak scenic highway, off US 24 at Cascade.
TRAILS off Independence Pass on State Highway 82 between Twin Lakes and Aspen.
OFF TRAIL RIDGE Road in Rocky Mountain National Park on US 34, northwest of Denver.

Flowers are in peak bloom from July 15th to August 8th in most locations. However, some plants, like the alpine forget-me-not, sometimes bloom earlier than the 15th. No alpines should be picked or dug up. Some that are supported on mat or tundra cushions are more than 300 years old.

Because flower buds are formed the previous season on these perennial plants, they are able to burst into bloom as soon as the weather allows. All plants are fragile and susceptible to destruction by trampling, therefore visitors are urged to stay on established paths. Take along warm clothing against sudden storms.

Alpine flowers to look for include the forget-me-not, rydbergia, wallflower, mt. harebell, wild candy tuft, fairy primrose, moss campion, alpine clover, sandwort, phlox, stonecrop, least lewisia, rosecrown, marsh marigold, snowlily, snow buttercup, snowlover, mt. sorrel, columbine, and big-rooted spring beauty.

Indian Paintbrush — best transplanted with the roots of sagebrush, which can add a silvery tone to the town garden.

The best place for a wilding beginner to start is with books. Recommended reading:
Handbook of Wildflower Cultivation—Taylor and Hamblin
Handbook of Rocky Mountain Plants—Ruth Nelson
Guide to Woody Plants of Colorado—George Kelly
Pioneering with Wildflowers—George Aiken

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