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Coffman also mentioned that parents and administrators are increasingly aware of the importance of quality athletic fields. "There's more of a focus on safety. Parents are going from school to school and comparing playing surfaces. If they see a better field across town, they want our field to look that good or better."

Daryl Smith, assistant grounds manager at Colorado State University, Fort Collins, couldn't agree more. He believes that as universities become more aggressive in their pursuit of shrinking student pools, more emphasis will be placed on the school's landscape.

"My feeling is that the landscape's quality has a huge impact on a person's decision to attend a particular university," says Smith. "You get mom and dad here and take in all the trees, the grass, and the pretty flowers and it's impressive."

Nearly everyone interviewed by LANDSCAPE MANAGEMENT felt that the industry needs to do a better job addressing critics of chemical use.

Shulder, who has been in the green industry for more than 40 years, says, "I've seen tremendous strides made in the green industry, but the one thing I haven't see is increased public awareness."

Shulder notes that "we need to be more positive than reactionary," which is a primary factor behind resurrecting the Green Industry Summit as the Landscape Environmental Resource Council in 1990.

"We're the environmentalists," exclaims Shulder. "We're the ones out there day after day taking care of the landscape. Critics don't talk about the benefits of chemicals at all. They're tremendous. We've got to turn it around, and now is a good time to make a move."

Bill Johnson, North Carolina DOT, agrees that the climate is right to bridge the gap between the green industry and its critics. "There's some middle ground out there. The radical element is there, but reasonable people are involved as well," says Johnson. "We should do a better job of communicating, of finding that middle ground. To insist that we abandon pesticides is ridiculous."

Allan Shulder

Bill Johnson

Adds Smith: "People's attitudes have changed. They're more aware of the fact that things are building up in the environment. For right or wrong, we seem to have put that out of our minds. Now we're opening up and taking closer look at it."

Smarter chemical use

The results of this reawakening, says Smith, are improved targeting of pesticide applications, the use of bio-controls and IPM, closer monitoring of chemical applications, a concerted effort to use adaptable species, and a back-to-basics approach toward cultural practices.

Tomorrow's labor pool may be shallow, but the employees drawn from it are likely to be better trained, according to Smith, who has five degreed employees on his 17-man staff.

"The labor market will be much better, even though it may cost a little more," says Dave Nelson, roadside development specialist with the Pennsylvania Department of Transportation. "There's more training today in- and outside-house."

Government landscapers are fortunate to be outside the competitive labor pools of the open market. Allen Goldapp, Jr., manager of grounds and horticulture at Southwest Texas State University, thinks that the competitive nature of the landscape market forces company owners to rely on low-paid employees. "The landscape market in this area is very cutthroat," says Goldapp. "Business owners have to use low-priced labor rather than professionals if they're going to make a living. That's a situation that's going to have to change."

Landscapers in the government sector appear to be less affected by this competitiveness because their employees enjoy more job security and (usually) higher wage rates.

Resiliency will remain an important element for government landscapers in the 1990s. By increasing public awareness about the benefits of turf, chemicals, and well-maintained athletic fields and school grounds, landscapers will go a long way toward insulating themselves from budget fluctuations. **LM**

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THE STORY BEHIND BIO-CONTROLS

Today's biotechnology boom means landscapers will enjoy a wealth of bio-control agents in the near future.

by John D. Briggs, Ohio State University

Before today's wide interest in biological controls, the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Agriculture (USDA) encouraged manufacturers to develop "growth regulating chemicals" to attack vital growth activities of insects and mites. In so doing, the EPA wanted to spur development of chemicals that destroy insects yet have no effect on humans, plants or animals.

Growth regulating chemicals work two ways. Either they prevent insects from becoming adults or they interfere with the completion of the insect's skeleton.

Fortunately for landscape professionals, today there is active competition in the pesticide industry for formulations of custom-designed bio-controls. The products will be useful for agriculturists and landscapers.The competition leading to the rapidly advancing technology originated with the products that are still marketed by two imaginative industrial giants who have continued the development of insecticidal toxins produced by *Bacillus thuringiensis* (BT). These are Sandoz Corporation, marketing Thuricide, registered in 1958; and Abbott Laboratories, the producer and market share leader with Dipel. Both corporations are major players among others in developing formulations of genetically engineered bio-controls.

The industry is demanding an increase in the persistence and the stability of bio-controls. In addition, genetic engineering is undergoing a biotechnology boom as researchers seek to incorporate into plants the production of insecticidal toxins by bacteria.

Dr. Briggs is professor of entomology at Ohio State University, Columbus. His current research includes participation in a biotechnology team researching new formulations of bacteria in bio-control agents.

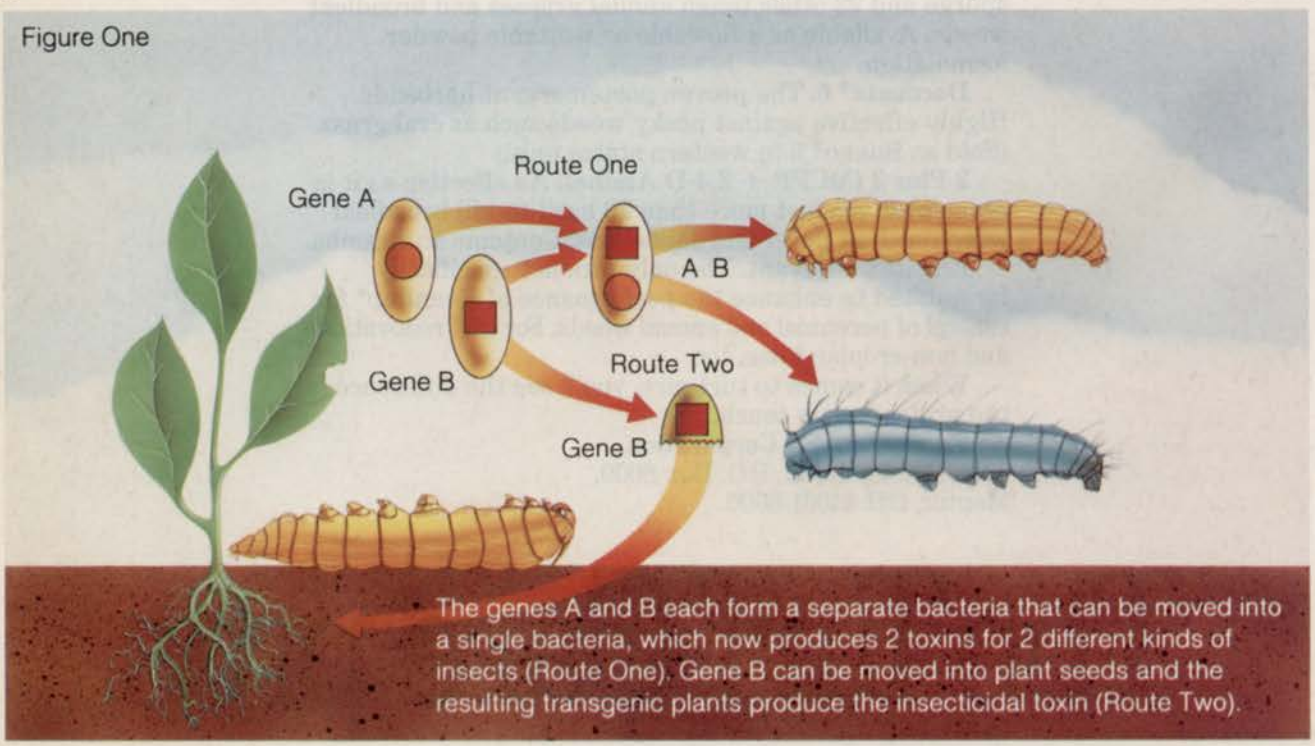
Research goals

By adding insecticidal toxins from bacteria to all the other materials that plants produce, researchers may be able to create new plant varieties with built-in bio-controls.

Another objective is to develop a formulation of bacteria which inhabit plant roots, stems or leaves. The idea is to alter plant bacteria so that they have insecticidal qualities.

This procedure is like one used to change the bacteria on strawberry plants. The new bacteria lowers the freezing point of water, thereby re-

Figure One



The genes A and B each form a separate bacteria that can be moved into a single bacteria, which now produces 2 toxins for 2 different kinds of insects (Route One). Gene B can be moved into plant seeds and the resulting transgenic plants produce the insecticidal toxin (Route Two).

ducing frost damage to the strawberry plant.

The genes factor

Genes are elements in the cells which are the building blocks for bodies of all organisms, including plants, animals, bacteria, fungi and nematodes. Genes carry the inherited blueprint for the characteristic shape, size and behavior of the organism. In humans, for example, genes determine physique and abilities to learn and behave.

Genes are complex chemicals that influence cells to do specific jobs. Many different genes are needed to interact in each cell to produce a whole human, animal or plant.

Manufacturers of bio-controls are moving quickly and successfully to add, remove or change certain genes in animals, plants and bacteria. For example, genes can be chemically and physically extracted from a bacteria. An attempt is then made to put them into another living organism, first in both laboratory and greenhouse experiments then in the field.

Scientists do not shift genes around in humans to change or build a better person—yet. But it is becoming big business to engineer custom-made, safe, useful bio-controls, many of which will be used in certain landscape activities.

Combining genes

Some bacteria can exchange genes with each other through their cell walls when the same kind of bacteria are mixed closely together in soil. This means that different kinds of genes responsible for different kinds of insecticidal toxins can be exchanged or combined.

For example, strains of *Bacillus thuringiensis* (BT) found in different insects around the world can have any one of 20 different types of genes. These genes influence the production of many different insecticidal toxins, some with more or less insecticidal activity than others. By either having scientists move the genes from one strain of BT to another, or allowing the natural exchange of genes between strains of bacteria, different combinations of genes can be developed into a single new strain of bacteria (Fig. 1, route 1).

Chemical alteration

In addition to moving whole genes, the genes themselves can be changed by specific chemical actions. Changing genes provides the opportunity to change toxins regulated by genes. Therefore, regular variations of toxins can help avoid the threat of insects and mites becoming resistant to bio-controls.

Moving genes from one kind of organism to another within the same type of organism (like within bacteria), or moving genes between different organisms (like from bacteria to plants) provides the opportunity for a new patent on the genetically-engineered organism. Examples of this would be a patented beneficial insect resistant to a pesticide for release with an insecticide treatment, or a herbicide-tolerant plant to survive herbicidal treatments in a landscape.

Cotton a forerunner

In 1988 and 1989, cotton plants were field-tested to demonstrate the successful incorporation of a bio-control

These grubs were exposed to milky spore disease, a widely used bio-control in the green industry today. The grub to the left displays early growth, while the one on the right shows advanced disease.

built into plants. These plants contained genes from bacteria that regulate the production of insecticidal toxins.

Incorporating bio-control genes from BT into bacteria that normally inhabit plant roots, stems and leaves has also been successful for controlling root-feeding caterpillars. This suggests that we can expect turfgrass varieties to be developed with built-in, custom-made bio-controls for insects that attack roots, as well as those that attack the crown and stems of grass.

Herbicide resistance can also be combined with insect bio-controls in plants.

Hard at work

Industry giants are continuing their genetic engineering programs to increase the tolerance of plants to herbicides. Monsanto Corporation works with the herbicide Roundup. Ecogen Corporation continues its development of Condor, a bio-control using BT for gypsy moth. The caterpillars of gypsy moth are targeted specifically while other collectible Lepidoptera escape injury.

Ecogen, using natural exchange of genes between bacteria, claims to have increased the insecticidal activity of Condor for gypsy moth by 7½ times. This is rearranging and concentrating the activity of a bio-control.

In a second product, Foil, the company claims to have combined the genes for production of two different toxins—one for the Colorado potato beetle and another for the European corn borer—into a single strain of bacteria. This is broadening the bio-control's range of activity.

Transgenic plants

When genes are incorporated into plants so that the plants produce an insecticidal toxin originally produced by the bacteria, the plants are called transgenic plants (Fig. 1, route 2). (Of course, a company that creates such a plant can patent it.) With transgenic plants, the genes from the bacteria are incorporated into the plant's permanent chromosomes.

Most transgenic work has begun on plants which are most easily genetically engineered: petunias, tobacco and tomatoes. Now progress is being made with plants less receptive to new genes: corn, rice and other grasses, cotton and soybeans.

There is another unique way to add the ability of a plant to produce an insecticidal toxin similar to that produced by bacteria. Genes from the bacteria are incorporated into micro-organisms that are always present in the plant's fluid transportation or vascular system. These bacteria are called endophytic bacteria. The plants that result from the gene transfer have a circulating insecticidal activity that can be described as a "systemic pesticide."

What is safe?

If we can make micro-organisms yield genes to other bacteria or plants, can the resulting bacteria or plants be safe for the landscape or for humans? Yes.

The toxins from bacteria, particularly BT, have been used for 30 years. The genes in BT which are responsible for the toxins, have been around a long time. So the use of the BT genes in another bacteria or a plant should not make any difference.

There are federal regulations for the release of genetically-engineered organisms. North Carolina has recently developed a comprehensive set of regulations that could serve as a model for other states wanting to regulate the production and use of genetically-engineered organisms. **LM**

THE IMPORTANCE OF ESTIMATING

STRATEGY

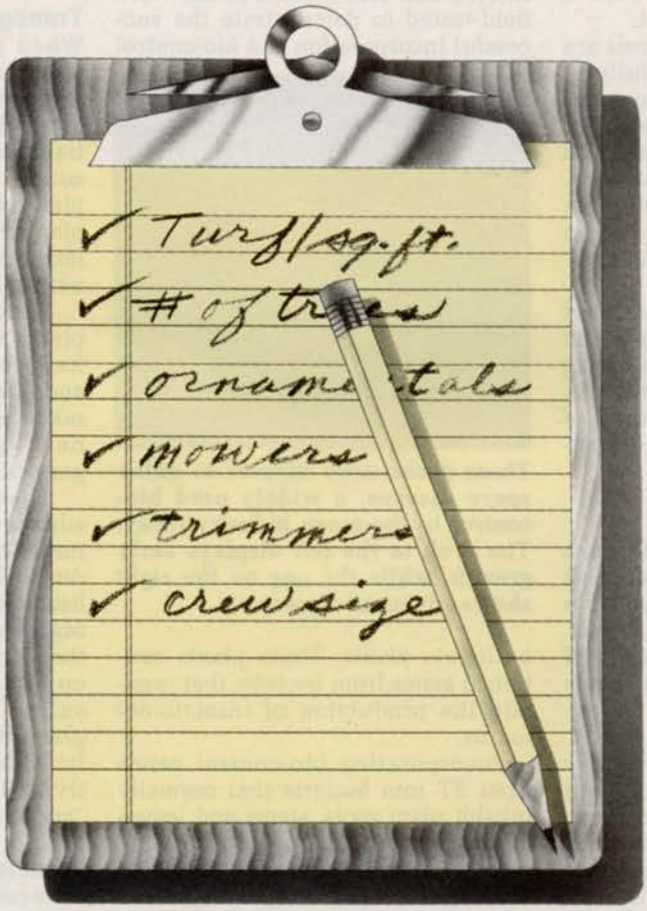
One of the nation's most well-respected landscape consultants tells how *not* to make a wrong bid.

by Charles Vander Kooi

In landscape contracting, having an estimating strategy is extremely important. The word "strategy" is used because that is just what it must be.

This business, in many respects, can resemble a war. As the owners and/or managers of a construction company, you are the Joint Chiefs of Staff. You make plans to initially approach the battle called "getting and doing" construction jobs. That is an estimating strategy. Then, as the battle proceeds and you see the effects of the owners' budgets and other contractors' bids, you make adjustments to your own battle plans.

You can never establish an estimating strategy and then expect it to work for you year after year. There are constant changes in the dynamics of your company, not to mention the changing conditions of other contractors' companies and the economy. You can't expect one strategy to continue to work. The most successful companies re-think their strategy in a major way on a yearly basis, and they constantly monitor it after several bids.



Four principles

To help you understand the importance of an estimating strategy, I want to explain four things that a good strategy can do for your company.

First, it can give you confidence that every dollar spent from your checkbook is going to come back to you through the estimates and bids that you produce.

One of the most beneficial things about having an estimating strategy is that no money falls through the cracks between what you pay out and what people pay your company. If this is not well thought-out from the beginning, certain costs to your company—such as those that do not occur on every job or those that are hard to pinpoint—will be the very items that you do not cover in your estimates and bids. A well thought-out strategy will allow you to carefully and completely go through each item in your checkbook and consider the best way to recover that cost on your estimates and bids.

The major consideration is whether to include the item as part of job costs, labor burden or overhead. The decision should not be based solely on which is easiest for you (though that is a consideration), but also on putting it in a place from which it can be properly recovered.

Sometimes, mathematically it will not work to put certain costs in certain areas. There are contractors who lose tens of thousands of dollars every year because they have put things into a wrong category, or are combining certain things that should not be combined.

For example, estimating equipment costs has always been a great problem in construction. If it is considered as part of overhead, jobs that use very little equipment will be penalized and have to pay (through overhead) more than their fair share of your equipment costs. If you do what you should do and estimate your equipment costs on a job-by-job basis, then you must still put any equipment used for overhead purposes (e.g. the owner's truck) into your overhead figures. If you don't figure your equipment costs as I have just mentioned, you will have money falling though the cracks.

Second, a good estimating strategy will compensate for the variables that exist from job to job.

One of the most important things that you must recognize is that no two jobs are exactly alike. Every job has different site conditions, different approaches and different costs, regardless of whether the materials are the same. Because of this fact, a good strategy will give you flexibility to compensate for the vari-

ables that exist from job to job. I have worked with contractors who have made money on one job at certain unit prices, but when they used those same money-making prices on another job they lost money. They knew things were a little different but did not know how to properly compensate for those differences. A good estimating strategy should give you the ability to compensate for those differences.

Third, a good estimating strategy will give you the ability to control your jobs after you get a contract. This business is no less than a two-punch business. Punch No.1 is putting out a good, competitive bid. Punch No.2 is getting the work done for the amount of money that you estimated in your bid. A good estimating strategy will give you the ability, right from the estimate, to make that estimate become reality in the field.

Fourth and finally, a good estimating strategy will give you the ability to make sound business/financial decisions. That's right! Your estimating strategy is one of the most important places to gather information for those types of decisions.

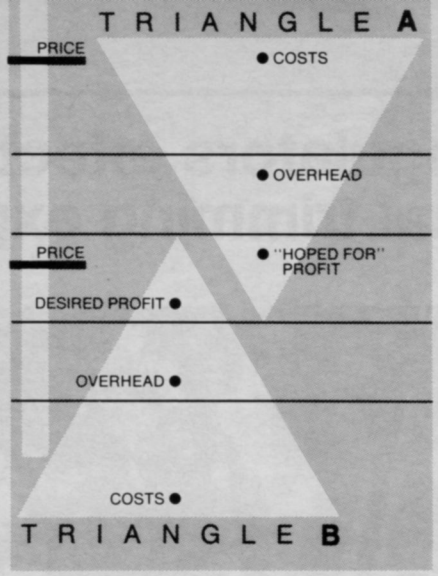
Our organization believes in setting up an overhead budget for a year in advance of the current year. We then set up overhead recovery percentages that will recover those costs based on how much work we anticipate we can successfully contract and complete with our workforce and the budgeted overhead. Those kinds of projections and plans give us a plumbline of where we think we are going. But things never work out exactly as we plan them. Therefore, a good estimating strategy will help us determine what changes in overhead costs, labor burden benefits or salary pay will need to be changed (and by how much) in order to remain profitable and competitive in our marketplace.

Wrong decisions

Many management decisions are based on emotions or on short-term situations. For instance, a company might want to hire additional people or pay benefits to its people or give them raises. Employees ask for these things and, based on feelings and without being able to explain why these things can or cannot be given, the request is granted or denied. Other times, a company might buy computers or other pieces of equipment without a system to measure whether those purchases are based on good, sound financial wisdom. A good strategy will give you that ability.

For example, let's say that you want to hire another secretary. Everyone seems busy and it seems like you could use her services. That should not be the major reason to hire her, however. If you can't afford her, some of the things that she would do may either need to be done by existing staff or not done at all.

The greatest determining factor should be based on the following: you established an overhead budget that did not include her, and you are acquiring jobs based on that budget. The question is, will hiring her allow you to get enough additional work to cover the cost of her salary? Or, can you raise your prices enough so that by doing the same amount of work with an increased overhead charge you will still get your projected amount of work for the year? That is how an estimating strategy can help you make sound business/financial decisions.



Elsewhere on this page you will see two triangles. Triangle A is an inverted triangle and shows how some contractors go out and get jobs with whatever price has worked before. They then work to keep costs as low as possible, keep overhead as low as possible and *hope* that at the bottom there will be some profit left. The problem is that they have no idea just how low costs and overhead must be in order to make a profit. And if something changes in price or in their company, they have no idea what effect that will have on the bottom line.

Triangle B shows someone with an estimating strategy and system. The same triangle is turned over. They start with estimated costs and budget overhead and a reasonable profit. They then know what they must do in order to make a profit. **LM**

Plant growth regulators effective on trees to reduce annual trimming expenses

Recent tests have shown chemical plant growth regulators to be useful on trees.

Chemical manufacturers and utility industry consultants are enthusiastic that the regulators will greatly reduce annual trimming costs, which can total $700 million.

The newest plant growth regulators are chemicals that inhibit the synthesis of gibberellin, the natural hormone responsible for plant growth, according to Paul Johnston, vice-president of Environmental Consultants, Inc. (ECI), of Southhampton, Pa.

ECI began testing tree growth regulators in 1982 while developing methods to inject chemicals directly into trees under pressure. "If applied properly," says Johnston, "growth chemicals can reduce gibberellin production by as much as 85 percent. The chemicals don't totally shut off the production of gibberellin. (But) growth is dramatically reduced without harming the tree."

The ideal growth regulator will slow plant growth and extend the time interval required to trim trees and shrubs without harming the plant, according to experts.

Mature trees must be trimmed every one to three years on average, depending on region, species and local growing conditions. The ideal growth regulator will slow plant growth and extend the time interval required to trim trees and shrubs without harming the plant.

New compound is working

Prunit is a new compound developed by Valent U.S.A. Corp. (formerly Chevron Chemical Company). It has shown "excellent growth control characteristics on 21 species of trees," according to Raymond R. Bruns, recently retired from Union Electric Co. of St. Louis. The tests were conducted in Missouri, Illinois and Iowa.

Bruns says field tests indicate Prunit can extend trimming intervals by two years or more in some tree varieties with "very little, if any, phytotoxicity problems."

In commercial applications, as described by Johnston, crews drill holes into tree trunks at selected spacings. Holes about $3/16$ inches in diameter are drilled from 2 to $2\frac{1}{2}$ inches long into active sapwood at slightly downward angles. "The trick," says Johnston, "is to get the holes as close to the actively conducting xylem tissue as possible."

Tree species, location and weather conditions can affect the growth response of chemical growth control products.

Pressurized injector probes then force the growth regulator into the tree.

Depending on the time of year, tree species and growing conditions, Prunit can begin reducing growth in four weeks, Johnston says.

"Further field trials and evaluations are required to determine optimum injection site spacing rates, depth and angle of bore holes, timing of injection, and other factors for each tree species.

"If everything in the application process goes well," says Johnston, "you will get good results from trunk injection.

"In most tree species, we're typically seeing about a 50 percent reduction in branch and twig elongation the first year after treatment with Prunit. In some cases, growth control is well over 80 percent."

But the variables of tree species, location and weather conditions must be considered, for the effect they can have on growth response of Prunit and other chemical growth control products. Johnston says the trim cycle can be extended from two to five or more years.

Despite evidence that chemical growth regulators pose minimal health risks when used properly, Johnston says utilities have been slow in committing to a chemical growth control program.

Take note of the variables

"Utilities are beginning to compare chemical control costs with conventional mechanical trimming practices, says Johnston: "We're beginning to get enough data to project when trees should be treated, how long the growth response will last and how much trimming costs can be reduced."

Johnston estimates that a typical utility with a $9 million, three-year trimming budget could possibly save as much as $300,000 by using growth control chemicals to extend the trim cycle by one year.

If the cycle could be extended for three to five years, Johnston calculates a potential savings of $840,000. **LM**