Problem Solving: A Creative and Systematic Approach

by Thomas D. Landis

We all experience problems in our daily lives and most people develop their own problem solving techniques through personal experience or their professional training. Because every problem is different, however, someone's "pet" problem solving technique may not be the best or the most efficient. Methods based on trial and error, for example, may be useless in a crisis situation when time is at a premium.

Problems are nothing new to nursery managers. Administrative constraints, site deficiencies, and equipment breakdowns are just a few of the problems that occur daily in tree or native plant nurseries. Good managers realize that problems are a natural part of any operation and must be dealt with directly, quickly, and effectively.

What constitutes a problem?

"Well, l tell you there's no problems, only solutions." — John Lennon

My favorite definition of a problem is any situation in which there is a difference between "what is" and "what what should be" (Van Gundy 1981). This definition emphasizes the relative nature of all problems. Defining problems always involves value judgments—what is a problem to one person may not be to another. The values or objectives of any organization will at least partially define the nature of its problems.

A complicating factor is that the differences between "what is" and "what should be" are frequently dynamic. In the case of seedling quality, the "what is" aspect changes with the physiological and developmental status of the seedling during the growing season or with short-term changes in weather. The "what should be" aspect of seedling specifications changes from year to year and from customer to customer. Because each crop and the weather each year is different, the best way to document daily activities is to have key nursery employees keep a daily log (Figure 1A). For example, the person doing the irrigation and fertilization should write down exactly what they do each day on a established data sheet. Then, if a problem with plant growth is observed, it's easy to go back and find out exactly what was applied.

Our objective in forest and native plant nurseries is to grow quality plants in a relatively short time frame. Whenever someone asks me to help evaluate a nursery program, the first thing that I ask is to see some growth

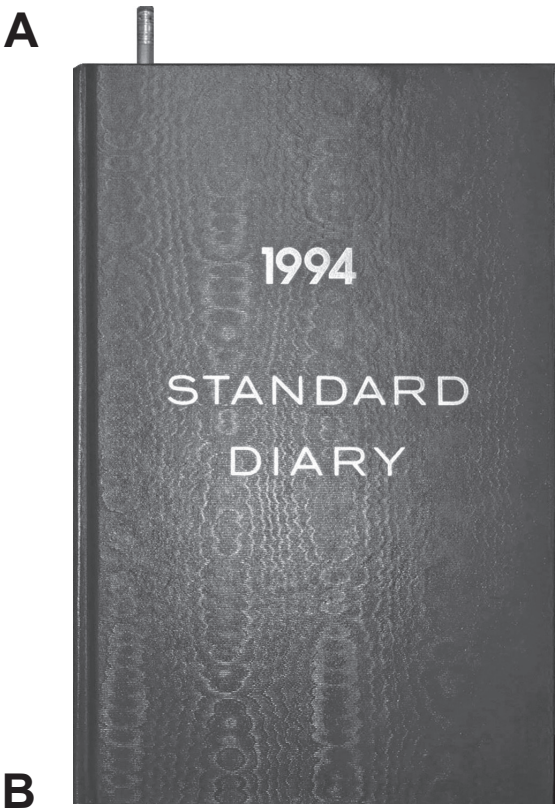

Figure 1 - One of the easiest ways to determine if a problem exists (the difference between "what is" and "what should be") is keep a daily diary (A), and to develop plant growth curves (B), which are based on past nursery records (Landis 2011).

data. It's difficult to notice and, more importantly, to quantify a nursery problem without good growth records (Figure 1B).

Traditional Approaches to Problem Solving

Managers must rely on their own experience and analytical skills to solve problems, and numerous techniques have been tried. Before investing a lot of time in problem solving, make sure that a real problem exists—some apparent problems can be resolved by merely taking a closer look at the situation or by readjusting expectations. Traditionally, problems have been solved in several ways.

The ostrich approach - These people ignore problems in the hope that they will eventually go away. Some problems do seem to solve themselves, or, if ignored long enough, may be solved for us. More often, however, problems that are ignored become even more serious or spawn a second generation of problems.

The panacea approach - This involves applying a "tried and true" solution without regard to its suitability for different problem situations (Van Gundy 1981). The panacea approach is a favorite of experienced managers who may have achieved positive results in the past but who overlook the variable nature of most problems or the advent of new technology.

The shotgun approach - People who use the shotgun approach believe that if enough solutions are tried, one of them should surely work (Van Gundy 1981). Many people, when confronted with a problem, feel that it is best to "do something" as quickly as possible; the danger is that some of these haphazard solutions may actually make the problem worse.

Roadblocks to Creativity

"Everyone is a prisoner of his own experiences. No one can eliminate prejudices, just recognize them." —Edward R. Murrow

Some people are naturally creative, but most of us have to work at it. Unfortunately, the human mind has several inherent processes that inhibit creative thinking.

Conditioned thinking - Most people develop a certain fixed way of thinking based on their previous knowledge and training (Beveridge 1957). Once a thought process is formed, it is usually very difficult to overcome. Most professional groups are guilty of such conditioned thinking, and nursery managers are no exception. Realizing this common pitfall is the first step in dealing with it.

Persistent errors - Having committed an error once, we often have an unconscious tendency to repeat the error again and again (Beveridge 1957). Apparently, the human mind is unable to detect these persistent errors. Often, getting a fresh perspective, such as having someone check your work, is effective.

Functional fixedness - This is the tendency to see only one use for an object. Unfortunately, the more highly specialized a person's field is, the more likely that person is to fall victim to this trait (Campbell 1977). One of my favorite quotes is: "People who are good with hammers see every problem as a nail".

Five Steps to Creative Problem Solving

Even novice nursery managers can become proficient problem solvers by following a systematic procedure based on creative thinking (Landis 1984). An effective problem solving procedures consists of five steps (Figure 2).

"Trouble that is easily recognized is half-cured." — St. Francis de Sales

Step 1. Identifying the problem - A problem has to be noticed and acknowledged before it can be solved. Problem identification requires knowledge and experience because a manager must know what is right before being able to recognize what is wrong: nursery managers must know what a healthy seedling looks like before they can identify a sick one. Managers must be observant and open minded, and think in terms of the differences between "what is" and "what should be". Because problems often develop gradually, these individual differences may go unnoticed until the situation reaches a critical level. Problem identification is also subject to changes in the state of knowledge about a specific operation. An increased understanding of a certain procedure can expose problems where they either did not exist before or lay unseen.

"Thinking a problem through is hard for the untrained mind." - Anonymous

Step 2. Analyzing the problem - Problem analysis begins with the development of a clear statement about

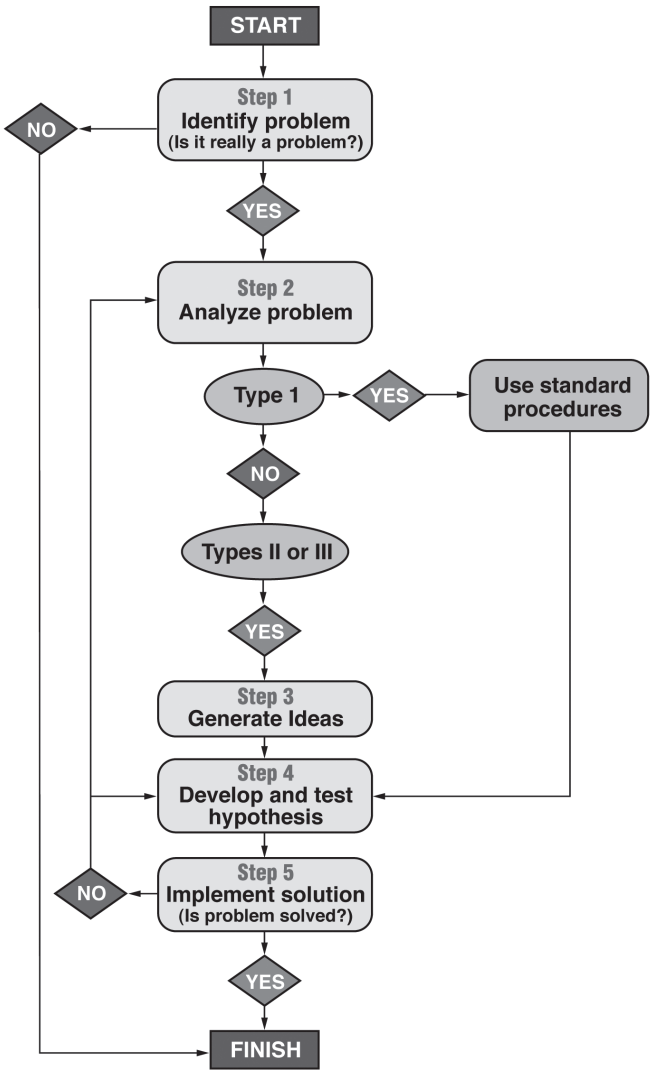

Figure 2 - This problem solving flow chart consists of 5 steps and can be used to solve a variety of nursery problems (Landis 1984).

the situation. Once identified, the problem should be described as accurately as possible; asking the questions ***what, when, where,*** and ***how much*** are often helpful. Make a list of knowns and unknowns to order your observational data in some way. The trick is to carefully delineate the boundaries of the problem before attempting to solve it.

Try to observe with an impartial, open mind and not to confuse symptoms with causes. Because it is impossible to observe everything closely, be discriminating—try to identify the significant characteristics. Often, the exceptional attribute of a problem is the critical element and can lead to the explanation of what happened (Beveridge 1957). Double check to be sure that the stated problem is the real problem; too often it is not. Furthermore, the real problem can be easier to solve than the stated one because it is almost impossible to solve a poorly defined problem (Furuta 1978).

Once the significant information has been gathered and organized, the problem should be ranked in terms of importance, urgency, and change (Rice 1981).

The ***importance*** of the problem will dictate whether it is worth solving, assuming it is solvable at all (Furuta 1978). Specify the available resources (money, personnel, time) that can be expended on the solution; some problems just cannot be solved economically.

The ***urgency*** of the situation will determine whether it must be dealt with immediately or can be postponed. Consider the amount of time that can be allotted to the given problem.

The ***change*** in nature, if any, of the problem also must be evaluated. Determine whether the problem is getting better or worse or remaining the same; a situation that is deteriorating will be more threatening than one that is improving.

"In every work of genius, we recognize our own rejected thoughts."—Ralph Waldo Emerson

Step 3. Generating ideas - A good knowledge base, which is the primary prerequisite for the creative process, can be obtained from nursery literature, staff discussions, and experts in the forest and native plant nursery field. Nursery literature includes manuals, technical books, and research publications. Publications in the fields of agronomy and horticulture or other related sciences can be valuable sources of new ideas; many of the cultural practices now used in tree nurseries were originally developed for other crops. Older nursery publications should not be ignored because many "outdated" ideas may be able to be modified for solving the problems of today. The Forest Nursery Notes database on the Reforestation, Nurseries, and Genetic Resources website (www.rngr.net) is an invaluable source of published information on nursery practices (Figure 3A). Not only does it contain all the articles from past issues of Forest Nursery Notes, but also the National Nursery Proceedings, Tree Planters' Notes, as well as valuable contact information.

The nursery staff is also a valuable source of information. Many of these people have accumulated a considerable amount of experience over the years. By presenting a problem at a staff meeting, nursery managers can benefit from a variety of different experiences and gain

URL: http://www.rngr.net **A**

Figure 3 - It's easy to search for published information on nursery culture at the Forest Nursery Notes database (A); visiting other nurseries and talking with other growers can be a big help in problem solving (B).

valuable new perspectives about the problem. Attending nursery meetings and workshops is an excellent way to learn more about nursery practices, and meet other growers who can be an invaluable source of information. The old biblical proverb that "there's nothing new under the sun" certainly applies to nursery problem solving. It's very likely that other nurseries have faced similar situations, so visiting other nurseries during field trips can be eye opening (Figure 3B).

Ideas can be generated by either single individuals or groups. Group sessions have the benefit of a variety of people with different perspectives, and the interaction of experts and less well-educated individuals can sometimes result in innovative ideas (Hunt 1982). Groups that contain individuals of different status in an organization, however, can actually stifle creative expression because lower ranked employees may feel intimidated. So, the best approach is to use both private cosultations and group techniques during problem solving.

"One of the great tragedies of science is the slaying of beautiful hypotheses by ugly facts." - T. H. Huxley

Step 4. Developing and testing hypotheses - Once a list of possible solutions is developed, each must be evaluated and decisions made so that ideas can be converted into hypotheses. In most cases, the available information will not point clearly to one hypothetical solution, and managers will have to make decisions based on incomplete evidence. However, most decisions are made under some degree of uncertainty because all the facts will never be known (Furuta 1978). Another of my favorite quotes is: "Just because we don't know everything doesn't mean we don't know anything."

A manager must keep an open mind during the evaluation process and take time to consider all aspects of the situation. The most obvious solutions are not always the best, and once an opinion has been formed, it is more difficult to think of alternatives. Beware of ideas that seem obvious and are accepted without question. In evaluating various ideas, it is important to consider all possible consequences so that the solution to one problem does not generate a new one. Managers must accept the fact that some ideas simply are not practical operationally or economically. However, ideas that initially seem impractical may be able to be modified to a more practical form. Unfortunately, most people are inclined to judge in the light of their own experience, knowledge, and prejudices rather than on the actual evidence. Remember that hypothesis testing takes time. If a problem requires an immediate solution, implementing an short term solution may be best until adequate testing can be completed (Beveridge 1957).

"A man's legs must be long enough to reach the ground." - Abraham Lincoln

Step 5. Implementing a solution - The last step in the problem solving system is testing the hypothesis operationally. Some hypotheses may seem adequate in small scale tests, but may fail under operational conditions.

Once a hypothesis has been tested and implemented, a decision must be made as to whether the problem is completely solved. If the hypothesis provides an acceptable solution to the problem, then problem solving is complete. If not, then it is necessary to return to Step 4 to develop an alternative hypothesis or to Step 2 to reanalyze the problem (Figure 1). For complex problems, several different hypotheses may need to be tested before an acceptable solution is found.

Becoming Better Problem Solvers

"Nature never overlooks a mistake, or makes the smallest allowance for ignorance." - T. H. Huxley

Figure 4 - One of the best approaches to nursery problem solving is to use an experienced nursery worker as a scout who regularly walks through the crop and documents any potential problems.

The basic role of management is to achieve certain specified objectives. The objective in forest or native plant nurseries is obvious: to produce a specific number of healthy seedlings on a given date and at a reasonable cost. Most nursery problems arise when this objective is not met, either directly or indirectly. Nursery managers must realize that learning is a continuous process but that they can never learn enough about the technical aspects of their operation. New information is constantly being generated, and managers must attempt to stay abreast of new developments.

However, pure knowledge about nursery science is not enough; it must be tempered by actual field experience. Experts can take shortcuts in problem solving because their knowledge is functionally organized; this skill is the result of many years of practical experience (Hunt 1982). Experience can be acquired directly through time on the job, or indirectly, through visits to other nurseries and discussions with other nursery managers. Actual "eyes on the ground" are absolutely necessary in creative problem solving, so assigning one trusted employee to be a scout is an excellent approach (Simone 1996). Nursery managers and growers have their hands full with a wide variety of management activities so it's a good idea to assign an experienced worker as a scout who regularly inspects the crops and documents any potential problems (Figure 4). Ideally, the scout is the same person who measures seedlings and develops the nursery growth records. Nursery scouts should also receive additional training in pest management.

Although problems cannot always be avoided, their effect can be minimized if managers have a flexible plan. Develop "What If?" scenarios for each nursery operation. For example, lifting season is always demanding due to frequently changing weather, so be sure to inform your workers accordingly. If the soil is too wet or frozen early in the morning, having a phone tree will make sure that each member of the crew is informed without creating extra work for the nursery managers.

Realizing that problems are to be expected can make a manager's job much more enjoyable. Just remember that "Murphy's Law" applies in spades to nursery work.

Sources

Beveridge WIB. 1957. The art of scientific investigation. New York (NY): Vintage Books. New York. 239 p.

Campbell D. 1977. Take the road to creativity and get off your dead end. Niles (IL): Argus Communications. 136 p.

Furuta T. 1978. Environmental plant production and marketing. Arcadia (CA): Cox Publishing Company. 232 p.

Hunt M. 1982. The universe within. New York (NY): Simon and Schuster. 415 p.

Landis, TD. 1984. Problem solving in forest-tree nurseries with emphasis on site problems. In: Duryea ML, Landis TD, editors. Forest Nursery Manual: Production of Bareroot Seedlings. Hingham (MA): Kluwer Academic Publishers. p 307-314.

Landis TD. 2011. The importance of crop growth monitoring. Forest Nursery Notes 31(2):19-24.

Rice CA. 1981. Rational problem solving—a training course manual. Boulder (CO): Programs in Communication Inc. 51 p.

Simone GW. 1996. A scout is critical to your IPM program. Greenhouse Management and Production 16(9):53-54.

Van Gundy AB. 1981. Techniques of structured problem solving. New York (NY): Van Nostrand Reinhold. 301 p.