

The state roadside programs are formulated in Harrisburg's central office and implemented at the district levels with modification to suit local needs as dictated by population, traffic, terrain, and other environmental factors. The district roadside unit is involved in all facets of design, construction, and maintenance that relate to the roadside and its environment. In this capacity, roadside slopes and soil areas can be designed, graded, rounded, finished, and vegetatively treated to yield the best finished product with maintenance in mind. In many cases, the pre-design public hearings commit the department to specific practices that, if not performed in concert with the project construction, would possibly be delayed indefinitely due to subsequent lack of funds, traffic congestion, political changes, and many other factors. Through this complete-project concept, all construction projects throughout the state, regardless of location, financing, or systems classification are given comprehensive consideration and treatment.

The 14 specific herbicide materials purchased on an annual basis have played a major role since the early 1950s. Roadside vegetation management along the 1200-mile Interstate Highway System and limited access highways has been centered around the culture of the legume-Crownvetch. These plantings have been virtually maintenance free for 20 years as the legume is self-feeding; controls erosion; smothers most weeds, litter, and volunteer trees; and provides both attractive bloom and foliage. Along older sections of these two classes of highway, vegetation succession is taking place to a climax forest ecology. In the lower-class roads, which constitute the larger percentage of the state's highway system, the climax vegetation is established and management of its encroachment through trimming, removal, and the use of herbicides continues.

Currently, we expend more than \$4 million annually on brushing, trimming, and tree removal in an effort to keep highways open for vehicular traffic, and these costs keep increasing as the emphasis on natural regeneration, reduced mowing, reduced herbicide use, and inflation continues. In order to combat increasing costs, we evaluated the technique of helicopter herbicide application for Canadian thistle control along several sections of Interstate and limited access highway in May and June 1979. We will be evaluating this technique of application for tree and brush control by using Krenite in late August. To date, this technique is very efficient and appears to offer a new dimension in the management of roadside vegetation.

CHEMICAL ROADSIDE VEGETATION MANAGEMENT PROGRAM  
IN NORTH CAROLINA  
W.D. Johnson

The North Carolina Department of Transportation's Landscape Unit has developed a very progressive herbicide and growth regulator program in an effort to facilitate the control of vegetation along our roadsides and reduce the hand labor and machine operations that would otherwise be necessary to properly control the vegetation. The main operations that are parts of this herbicide growth regular program are briefly described here.

There is a great savings potential in the cost of routine mowing through the use of growth regulators. The control of broadleaf weeds must also be included when attempting to control the rate of growth of grasses. Savings from this program range from approximately \$25 to \$40/acre/growing season.

In 1980, approximately 14 000 acres were treated and we estimated potential savings of \$560 000 by the reduction in the number of routine mowings. Generally, we hope that more than 50 percent of the area only will be mowed one time with the remaining parts possibly requiring two mowings. The normal number of mowings without treatment is 5-6 per season. We have used MH-30 and Embark as the two growth control agents with spring application and some limited fall application. The MH treatment is the only one that we have used that will allow for season-long control with just the fall cleanup mowing. Embark has shown excellent results when combined with a spring mowing after application and then, of course, the fall cleanup mowing. Also, 2,4-D is applied with either MH or Embark in a spring application for broadleaf weed control. In some instances, it is necessary to follow up in early June with another weed control spraying; however, we are attempting to go through the season with only the fall cleanup mowing. We have gotten excellent results from a 2,4-D-MCPP-Dicamba mixture for this follow-up spraying.

Over the years, we have used a large number of products in an attempt to control the vegetation under guardrails, as the specialized mowing and maintenance of vegetation would otherwise be very expensive. We have now begun to shy away from some of the long-term residual herbicides. Our current program involves a Roundup-Surflan or Roundup-Simazine treatment or a combination of these two preemergence herbicides with Roundup.

It seems obvious that various herbicides would provide significant savings over hand labor to remove vegetation that has grown into the joints of concrete-capped islands or through asphalt islands. We use residual type herbicides such as Spike or Pramitol under many of the asphalt islands and use a Roundup-Spike treatment normally for vegetation that has broken through if runoff is not a problem. One of the most effective treatments that we have used on concrete islands is to clean out the existing vegetation and blow out the joints with air pressure and then repour the joints with liquid asphalt containing Primitol 25E. At this point in time, we do not know how long this protection will last.

Brush control is important adjacent to bridges so that larger trees do not grow and affect the structure itself. The main brush control agent now being used is Krenite and we have found that the no-brownout characteristic is very beneficial. We also chemically prune limbs with this product. We are now beginning to use Garlon and a mixture of 2,4-D-MCPP-Dicamba on brush.

Vines and brush are the main problems along right-of-way fence lines that are visible to the highway. Krenite has worked well in controlling trumpet creeper and other vines and brush in this area. We are now experimenting with some Banvel pellets in areas not adjacent to wood lines.

As a clean out for existing vegetation, we have found no equal to Roundup. We are using Treflan 5G, Caseron 4G, and, in some cases, Surflan as preemergence treatments.

In portions of North Carolina, the Bermuda grass grows well, and we use Roundup to control this aggressive grass to prevent the failure of asphalt pavements. We have also used some Spike treatments placed immediately before the paving operation.

To control the vegetative growth around signs, delineators, and other stationary objects, we have used Pramitol 5PS and Spike 5G pellets. Runoff can cause serious problems when an excessive amount of pellets is placed on areas with any kind of slope.

Roundup is our main product for control of Johnsongrass. Asulox appears to have some potential for the control of Johnsongrass, particularly where

fescue grasses are growing. Asulox will not normally hurt fescue.

We attempt to control Kudzu along our roadsides and will enter into agreements with private property owners to treat roadsides adjacent to their property if they will agree to treat their own. We have used Krenite with good success as an early fall treatment along with Roundup or the 2,4-D-MCPP-Dicamba mixture as a spring-summer treatment.

Multiflora rose has been designated as a pest in North Carolina. We have used either Roundup, Banvel, or Krenite in an effort to control this pest. All three appear to be effective.

The use of herbicides and growth regulators, as listed here, seems absolutely necessary to provide the North Carolina Department of Transportation with the tools to control vegetation along our roadsides and maintain the aesthetics of our highway system. We are very proud of our strides in recent years in the use of chemical products to control roadside vegetation, and we are proud that some parties have indicated that our program is as progressive as any that can be found in the United States.

#### FLORIDA'S ROADSIDE VEGETATION MANAGEMENT PROGRAM Bill G. Morris and J.A. Lewis

Florida's Department of Transportation has long recognized the benefits to be derived from a sound vegetation management program. Florida has a combination of rural and urban conditions with nearly 12 000 miles of state-maintained roadway spread over an area of 60 000 miles<sup>2</sup>. The state is irregular in shape and is fronted by the Atlantic Ocean and the Gulf of Mexico. This geographic area, coupled with varied terrain, rainfall, temperature, and growing seasons, results in a variety of vegetation management programs.

Management of our roadsides begins at the design phase. We maintain a close working relationship with the department's design staff and support ongoing vegetation research that is performed in-house and with the university system where repetitious vegetation problems are best solved.

Generally roadside maintenance is categorized as either maintained or nonmaintained. Maintained areas receive routine and as-needed applications of fertilizer, mowing, and herbicides. Nonmaintained limits are allowed to regenerate and/or are supplemented with native tree species. Period fertility is accomplished by using a high-analysis (24-6-8) 50 percent water insoluble nitrogen source. Although this program contributes to a more dense, stable turf, it does not contribute to additional mowing requirements. Various size mowers are used on roadside applications. Frequencies vary depending on location and attending land use.

The department has developed a comprehensive manual on chemical weed and grass control that includes details of herbicide materials, plant identification, calibration programs, special considerations, equipment, and so forth. It provides detail and specifies desired treatment limits, nozzle configurations, and related application pressures and speeds.

A five-day classroom and field training program is held for applicators, and they must exhibit technical competency for certification. We have attempted to minimize the number of materials used in the program and evaluate them on a cost-effective basis. 2,4-D, 2,4-D-Dicamba, Banvel 720, Dalapon, Hexazinone (Velpar), Glyphosate (Roundup), Diquat

(Ortho), and Oryzalin (Surflan) are the mainstays of our current programs. These programs consist of selective weeding, brush and grass control, abatement, aquatic, drainage ditch, and ornamental work. A daily herbicide spray report is maintained by crews. The report provides for the recording of essential information and allows for program performance evaluation.

From an economic standpoint, Florida is seriously questioning mowing needs. A no-mow test area was established in 1977. This resulted in the recognition that a dense and uniform established weed-free bahia or Bermuda turf is acceptable in appearance, therefore, making it possible to virtually stop mowing in certain areas without serious consequence.

It was recognized at the beginning that for the projects to be successful, a well-established turf condition relatively free of competitive tall grasses and broadleaf weeds would be required. This was verified with the discontinuance of mowing. Control of broadleaf weeds has been successful with the use of 2,4-D and 2,4-D-Dicamba; however, control of the tall competitive grasses such as Johnson, vasey, guinea, smut, para, and napier is requiring an alternate program.

At the beginning of this program, no acceptable product or application techniques were available to selectively remove the competitive grasses from the desired bahias and/or Bermudas. We have since experimented with low-rate overspray programs by using Hexazinone (Velpar) and Asulam (Asulox or Johnix). Each of these provided favorable results for particular plant control but neither material has effectively removed all of the undesired grasses.

Our latest approach to the control of these grasses has been the Rope-Wick concept and using the herbicide Glyphosate. The unique factor in this procedure is that the material is applied only to the taller, undesired grasses by using the rope-wicks resulting in essentially no material waste. Control of the undesired grasses coming in contact with the wick is satisfactory.

With the information gathered to date, certain modifications to our management practices are being considered. These include the expansion of the rope-wick concept coupled with a reduction in mowing and expanded selective broadcast programs.

#### USE OF CHEMICAL TOOLS IN MANAGING VEGETATION ALONG TEXAS ROADSIDES Tom Allen

The vegetation management program of Texas has been designed to maintain the integrity of the asphalt surface, prevent or reduce soil erosion, provide safety for the traveling public, achieve maintenance efficiency, and provide beauty. The use of chemicals was demonstrated as the most efficient and economical method of controlling undesirable vegetation. Herbicides are the major chemical tool used along roadways; however, insecticides and plant growth regulators may become important as our knowledge increases.

The chemical vegetation management program was divided as follows.

1. Complete vegetation control (bare ground). The use of a residual herbicide at the proper rate will provide complete vegetation control unless resistant species are present. The number of these species must be considered. This type of vegetation management may be desirable in areas where it can be