Planting in Semi-Arid Regions in the United States

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There is less information available on roadside planting methods and materials in the semi-arid regions than in other regions of this country. The semi-arid region of the U.S. covers a wide territory and includes great differences in elevations, soils and adaptable plants. It is characterized by low annual rainfall. However, a simple comparison of annual rainfall in different parts of the country does not give the whole story from the standpoint of vegetation. In this whole region, the relative humidity is regularly extremely low. This dry atmosphere, combined with much wind, results in heavy evaporation losses so that the comparative moisture available to plants is actually even lower than is indicated by rainfall figures.

Over the centuries, nature has developed a big variety of plants that are able to survive and reproduce in spite of all the handicaps that plants must struggle against under the most adverse conditions. In this over-all development, time always has been, and always will be, a most important factor. Nature just will not be hurried no matter how important a construction project may seem to be and regardless of the most elaborate plans and detailed specifications. Modern construction engineers, accustomed to overcoming great natural handicaps in engineering, usually fail to understand the apparently stubborn lack of cooperation from nature in such a simple item as growing plants.

This discussion will be concerned chiefly with one small area in the semi-arid region. It is recognized that the conditions existing in this small area, the Air Force Academy site, by no means represent conditions throughout the semi-arid region. It has, however, many of the problems common to the entire region. It is an area where there has probably been more roadside development work than in any other comparable area within this region. The basic methods used for planting have been similar to those used by the Corps of Engineers and other organizations in this region. Adaptations have been made as needed to meet the special requirements of the site.

The Air Force Academy is located in the foothills of the Rocky Mountains a few miles north of Colorado Springs, Colo. The elevation there ranges between 6,500 and 8,000 ft above sea level. The normal annual rainfall for Colorado Springs is a little over 14 in. At Monument, only a few miles north of the Academy, the annual rainfall is over 19 in. One-half of this rainfall comes during the summer months and much of it comes in short heavy thundershowers. As a result there is heavy runoff and serious soil erosion.

The original plans for grading of roadsides on the Academy site was for 2:1 slopes on major cuts and fills. There was no provision for diversion of runoff from higher areas above the cuts. The soil on the site is a type that is extremely subject to erosion, thus the result was severe erosion on both cut and fill slopes.

After the original grading of roads was completed by the contractors, a program of eriosion control was undertaken. The land along the roads was owned by the Government, so in laying back slopes there were no right-of-way limitations that hamper some roadside development on Federal and state highways.

Slopes were laid back to 4:1 or better wherever practical, as frequently recommended by the HRB. Diversion ditches were installed to intercept excessive runoff to protect the slopes. The V ditches were changed to the flat bottomed and streamlined cross-sections as recommended by the HRB. The lay-back of slopes after the original grading had been completed increased the costs in may instances. However, by taking the water away from the roadsides by frequent diversion ditches most of the planned paved gutters along the roadsides were not needed. The laying back of slopes on fills in many sections made the slopes safe for traffic runoff and made the planned guardrails unnecessary. Along many sections, the savings in paved gutters and guardrails more than offset the cost of flattening slopes.

The disturbed areas on the roadsides have generally been topsoiled, seeded, and mulched with straw. With favorable rainfall, satisfactory stands of grass can be obtained without topsoil. Topsoil was used in this case to introduce seed of native weeds, to provide a tone-down of the light color of the graded subsoil and to provide somewhat better changes for grass establishment in the event of lower than normal rainfall. The objective of obtaining native weeds needs some explanation to those interested in roadsides in humid regions. In seasons with below normal rainfall, grass seeding frequently fails. Even in such seasons some of the native weeds are able to become established and develop roots that help in erosion control. A stand of weeds was acceptable if efforts to establish grass failed. Many of the native weeds produce an attractive appearance along roadsides and their limited growth does not provide the competition for grass nor the mowing problems that are common on roadsides in humid regions.

Most of the areas were seeded with a mixture of blue grama, western wheatgrass, crested wheatgrass, sand lovegrass, sand dropseed, smooth bromegrass and yellow sweet clover. Grain was used for overseeding most areas even though it was recognized that it would be somewhat competitive with the grass.

The seeding work has been generally more successful than can normally be expected in this region. This was due to the fact that during the past three seasons there has been better than average rainfall, which fortunately was well distributed for grass establishment.

Straw mulch was used throughout at an average rate of approximately 2 tons per acre. Soil was loosened to a depth of at least 4 in. before seeding and mulching. The mulch was well crimped into the loose soil and most of it remained in place in spite of frequent and strong winds.

Some of the native shrubs develop extensive root systems near the surface and are effective in controlling erosion. The most common plant of this type on the site is the scrub oak which occurs in dense clusters and is capable of withstanding a heavy flow of water. Other shrubs that are effective in checking erosion include the three-leafed sumac, mountain mahogony and snowberry. Unfortunately, the most widely distributed and most effective shrub for erosion control on the site, the scrub oak, is extremely difficult to transplant. At the request of the Air Force, the Horticulture Department of the Colorado State University conducted studies to determine methods for transplanting or propagating the native scrub oak. Tests with root stimulants and different methods of handling small plants and acorns failed to develop any practical methods for large-scale propagation of this plant. Special methods for handling seedlings offer the greatest promise, but growth is discouragingly slow. Some native plants can be moved readily if they are nursery grown or collected as young plants. Among the native shrubs that can be moved successfully and which hold promise for roadside planting with little or no watering are the three-leaf sumac, mountain mahogony, buffaloberry, and native roses. Thimbleberry, snowberry, shrubby cinquefoil, native cherries, pink locust and others may be used in more restricted and favorable locations.

Several of the native evergreens may be used in favorable locations along roadsides. Colorado spruce, Douglas fir and pinyon pine apparently can be transplanted most successfully in the larger sizes. Ponderosa pine suffers severely when transplanted in larger sizes. Best results are obtained in planting evergreens as well as deciduous stock in the seedling or very young stages of growth.

Slope is an important factor in establishing any kind of vegetation. In dry country, the direction of slope is far more important than in humid regions. A good example of the importance of planting in suitable locations occurred on the Academy site. During the spring of 1957 there were 1,005 ponderosa pines (2-2 transplants) planted on a slope facing south. They were planted on an area of 1.4 acres and the contractor was paid $2,400 to water the area during the summer. This watering supplemented the rainfall which in 1957 was the heaviest ever recorded by the weather bureau in Colorado Springs. In the fall of 1958 there were only 29 pines alive of the 1,005 planted. On a nearby slope facing to the north, over 30,000 ponderosa pines (2-2) were planted at the same time in the spring of 1957. These seedlings received no water to supplement rainfall. Spot counts on the north slope showed that over 90 percent of the seedlings had survived. This example provides further evidence that plants cannot be handled like most engineering materials, without proper consideration of location. The best plant material in the wrong locations cannot be expected to produce results commensurate with costs. This basic principle is of upmost importance on roadsides with steep slopes, particularly in regions of low rainfall.