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16. Abstract

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Plastic clays which show a poor tendency toward granulation can be modified by treatment with cationic polymers to favor vegetation establishment. Other treatments such as gypsum and certain soil amendments were not satisfactory. Plating with topsoil was very satisfactory, and better stands of grass were secured when topsoil was not mixed with the clay material.

Treatment of extremely acid material with massive rates of lime is effective for at least three years. The acidity increases gradually over this time.

Annual and some perennial plants can be selectively controlled in multiflora rose hedges, but most perennial weeds persist.

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ESTABLISHMENT AND MANAGEMENT OF ROADSIDE VEGETATION, 1971

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DISCLAIMER

ABSTRACT

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Treatment of extremely acid material with massive rates of lime is effective for at least three years. The acidity increases gradually over this time.

Annual and some perennial plants can be selectively controlled in multiflora rose hedges, but most perennial weeds persist.

Key words: erosion control, soil acidity, liming, herbicides.

SUMMARY

This report describes tests installed during 1971 to study the establishment of a grass turf for erosion control and to control unwanted plants growing in shoulder pavements and median barriers. The specific objectives of this study are:

1. To determine habitat restrictions together with biological requirements, plant materials, and procedures to establish a vegetative cover for erosion control.

2. To develop methods for controlling unwanted plants growing in engineering facilities.

Roadside materials having a PI greater than 20 were treated with admixtures of gypsum, reclaimed rubber, ground bark, and several synthetic polymers. Of these materials, the cationic polymers were most consistent; reclaimed rubber, ground bark and synthetic aggregate fines varied by location. Gypsum performed well in these tests, but the best stands of grass were secured by plating the slopes with topsoil.

The test with acid roadside materials showed that bermudagrass, kleingrass and bahiagrass were quite acid tolerant and came up to good seedling stands. Weeping lovegrass appeared to be less tolerant of acidity. The acidity of a slope treated in 1969 with lime gradually increased, and a top dressing of lime and fertilizer was applied.

Tests initiated in 1969 to chemically control plants interfering with mowing near median barriers were continued. Where the offending plants were annuals, they could be selectively controlled using a combined contact material and pre-emergence herbicide. Simazine was the most effective of the pre-emergence materials tested. Most perennial plants were not controlled by this treatment schedule.

Several experimental materials were compared with a mixture of fenac and dicamba with either prometone or bromanil for controlling a mixture of perennial weeds and grasses growing in asphalt shoulders. None of the experimental materials were as effective as these mixtures.

IMPLEMENTATION STATEMENT

These studies on vegetation establishment and vegetation control produced the following results which should be considered.

1. Where acid soil materials are known or suspected in construction, the design should accommodate this condition. The acid material should be removed and a backfill two feet in depth installed. The acid material should be placed in the center of fill sections to prevent its damaging vegetation on these slopes.

2. Median and other landscape plantings can be maintained free of annual weeds with selected pre-emergence herbicides, or with a combination of contact and pre-emergence herbicides if the annual weeds are present. Perennial weeds in median plantings cannot be selectively controlled using herbicides.

Work is continuing on modification of restrictive soil properties and development of herbicidal treatments for perennial weeds.

INTRODUCTION

Vegetation is an integral component of the roadside. Properly installed, it stabilizes slopes, channels and other soil areas against the forces of erosion; emphasizes engineering features; and provides the driver with a panorama which is continually changing. Plants growing in pavements need to be controlled as an aid to maintaining the integrity of the facility.

This report describes results from tests installed in 1971 to establish a cover of desired plants and to control unwanted vegetation. These tests are continuation of those reported in Research Report 142-1 (McCully, Bowmer and Stubbendieck, 1970).

PART A: VEGETATION ESTABLISHMENT

PROBLEMS

Soil materials encountered in road construction which possess objectionable physical or chemical properties will not support plant growth. Specific soil conditions under study are:

1. Dense soil materials having a plasticity index (PI) greater than 15 support only a marginal stand of vegetation at best. These plastic materials are encountered in scattered locations throughout Texas.

2. Acid materials having a pH lower than 4.5 will not support plant growth. The acidity of some materials encountered in northeastern Texas has measured as low as pH 1.8.

PROCEDURES

Problem sites were selected in consultation with the Contact Study Representative, and specific test locations (Fig. 1) were designated following an on-site inspection with engineers in that particular district. The treatment schedule was coordinated with the space available, and replications were assigned to site features such as slope orientation or differences in physical or chemical soil characteristics.

Following site organization, soil samples were taken and laboratory measurements made. Equipment, planting seed, and other needed materials and services were provided by the local maintenance section of the Texas Highway Department. To install each test, admix materials were applied, tillage was done, planting materials were applied, and the planted area was covered with a hay mulch.

1. Modification of soil physical problems. A soil material functioning as a plant growth medium should possess a granular structure to properly supply moisture and aerate plant roots. Dense clayey or shaly materials on the faces of cut or fill slopes have not been subjected to the weathering processes which bring about the good tilth of surface soils.

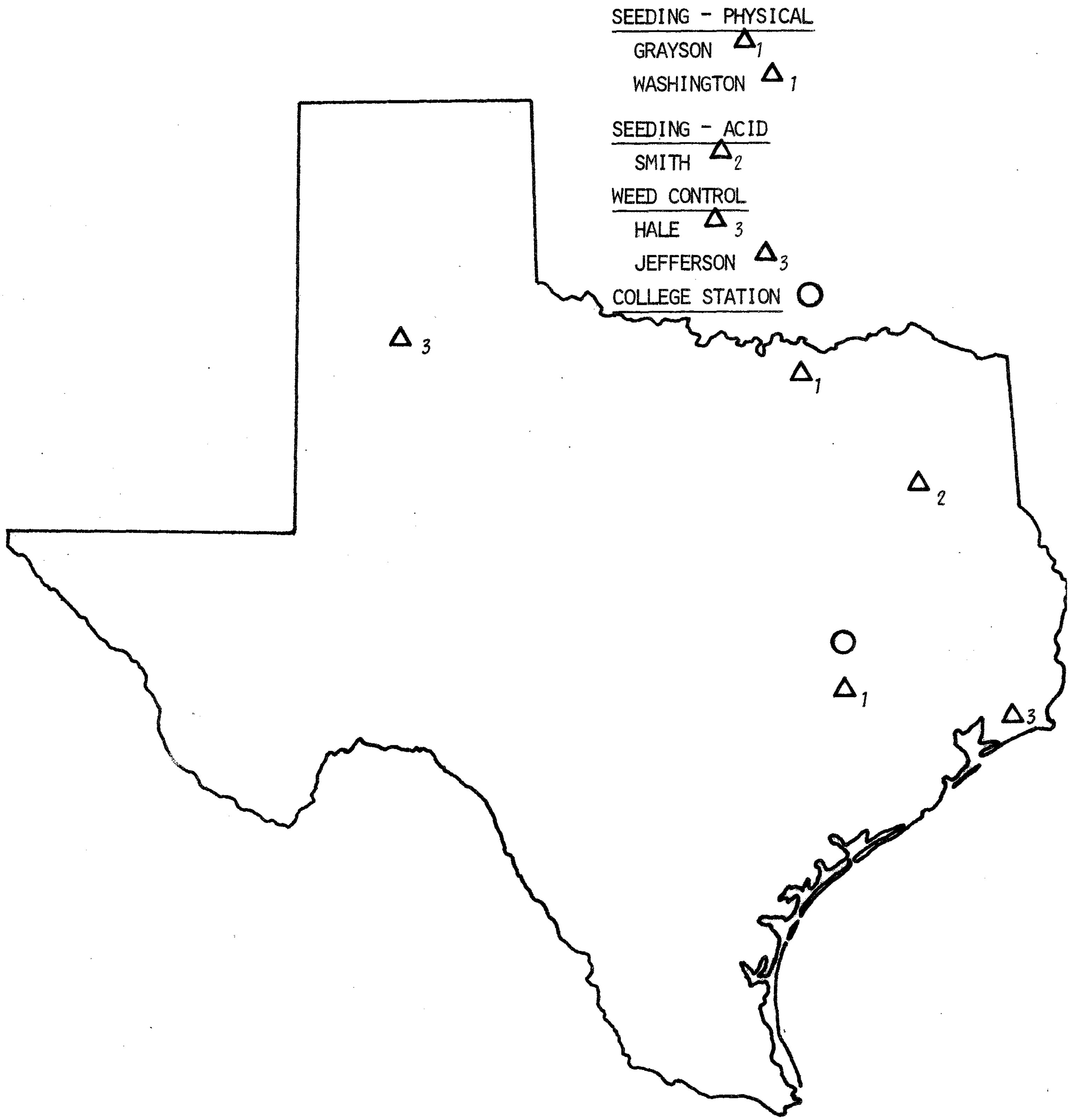

Figure 1B. Location of experimental sites for vegetation studies, 1971.

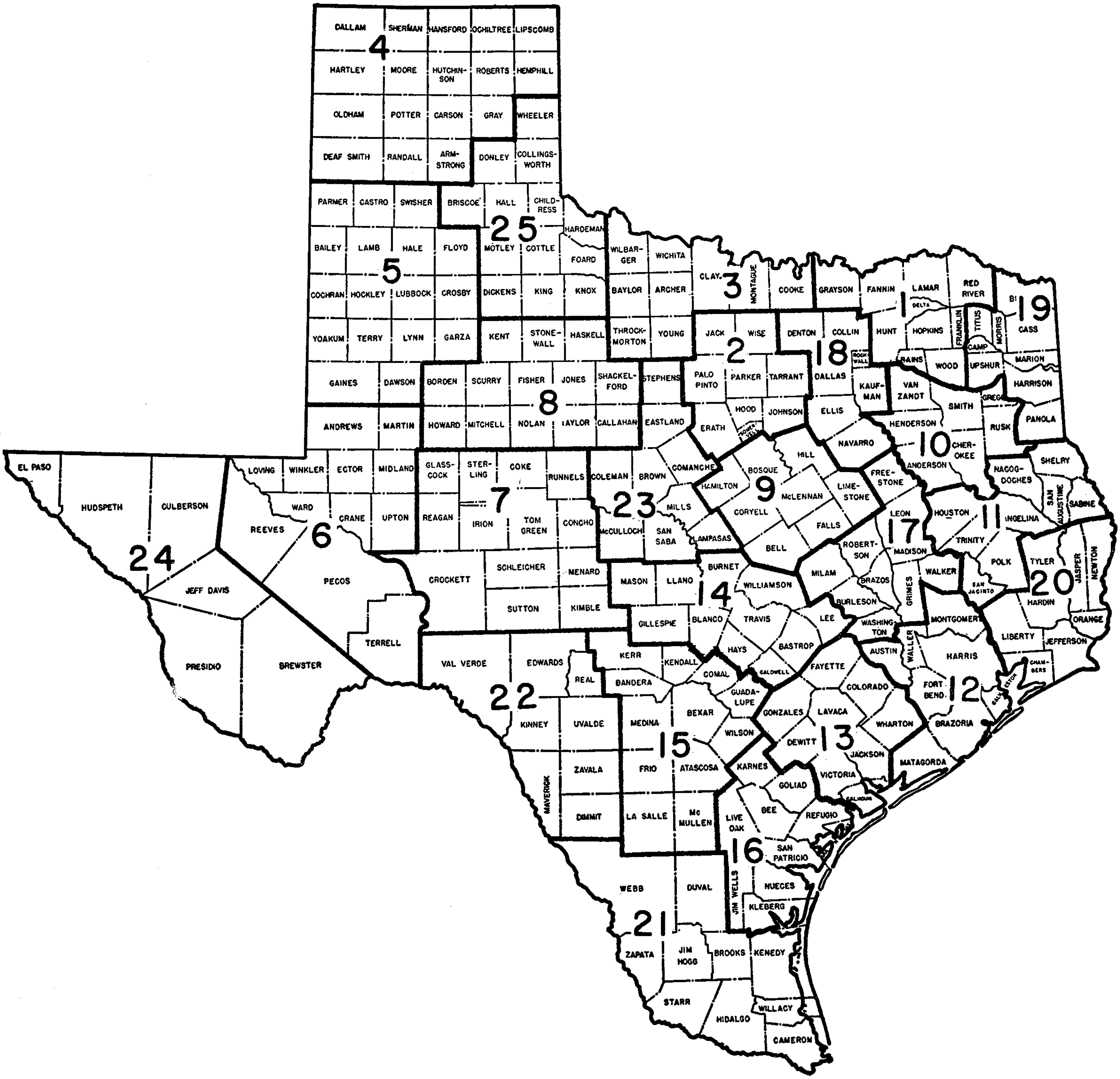

Figure 1A. The Texas Highway Department is organized into 25 districts.

Granulation of these dense subsurface materials can be induced by tillage with a pulvi-mixer or scarifier, but the soil granules puddle back into an amorphous soil mass on wetting.

Materials tested (Table 1) were those which would perpetuate aggregate identity or lines of weakness generated by tillage. Fertilizer analysis was that commonly in stock, and planting materials were specified for the soil and existing plant growth conditions at the test site. Details of individual tests installed in Grayson and Washington Counties follow.

Grayson County (THD District 1).

This test was installed in mid-June on 1:3 backslopes along FM 3133 southeast of Van Alstyne on clayey materials underlying Houston Black-Austin clay soils. Plot length varied on backslopes which were 20 to 40 feet wide. Soil amendments were applied at random over 4 replications, either before or after pulsive mixing to a six-inch depth. Amendments applied before tillage were gypsum at 2 and 4 tons per acre; as well as reclaimed rubber (Skid Scrap Rubber)1/, urethane (Thurane), ground bark (Soil Builder) and synthetic aggregate fines (Buckshot Fines), each at rates of 4, 8 and 16 percent (v/v) of the surface 6 inches of soil. Amendments applied after tillage were Gelgard M, CMC and Reten 210 at rates of 200 and 400 pounds per acre. In addition, one plot in each replication received a 6-inch plating of topsoil.

A slurry containing 400 pounds of 16-8-8 fertilizer and a seed mixture consisting of 4 pounds green sprangletop and 8 pounds hulled common bermudagrass per acre was applied using a hydroseeder. The seedlings were mulched with hay tacked with asphalt applied with a straw blower.

Washington County (THD District 17).

This test was installed in late July on 1:3 backslopes along FM 1948 south of Lake Somerville on clayey materials underlying Edge-Tabor soils. Plot length varied on backslopes which were from 20 to 27 feet wide. The soil amendments were applied at random across 4 replications. Amendments, rates, and tillage were the same as for the Grayson County seeding, except that an additional treatment of topsoil was applied and tilled before planting.

A seed mixture containing 4 pounds green sprangletop, 8 pounds hulled common bermudagrass and 10 pounds of yellow bluestem per acre was applied using a hydroseeder. Four hundred pounds per acre of 16-20-0 fertilizer was also incorporated in the seed slurry.

1/ Commercial trade names are mentioned only to facilitate identification and do not imply an endorsement of a particular material or the exclusion of others.

Table 1. Effectiveness of various soil amendments relative to the plant stand secured without treatment. [a]

		1968			1969			1970		1971	
Material	Rate/ acre	Taylor	Brazos	Rusk	Burleson	Hidalgo	Webb	Brazos	Grayson	Grayson	Washington
Aggregate	300 cu ft									+	+
	600 "									+	-
	1200 "									+	+
AP30	100 lbs	0	+	0							
Aqua-gro	17 gal	0	+	-	-	0	0	0	+		
CMC	100 lbs	0	+	0	0	0	0	0[1]	0[1]		
	200 "	0[2]	+	0	+	+	0	0[3]	0[3]	+	+
	400									+	+
Gelgard	100 lbs				0	+	0	0	0		
	200 "				0	+	+	0	0	+	+
	400 "									+	+
Ground bark	300 cu ft									+	0
	600 "									+	+
	1200 "									+	-
Gypsum	1 T				0	0		0	0		
	2 "		+	+	0	+		0	0	+	+
	4 "									+	+
Hay	4 T		0	-							
	8 "		0	0							
Lime	1 T							-	+		
	2 "							0	0		
Metroganic	2.5 T							0	0		
	5.0 "							0	0		
	7.5 "							-	0		
Reclaimed rubber	300 cu ft									+	-
	600 "									+	-
	1200 "									+	-
Reten 210	100 lbs	0	+	-	-	0	0	0	+		
	200 "				0	+	0	0	+	+	+
	400 "									+	+
Topsoil	unincorporated									+	+
	incorporated								+		0
Urethane (pre-till)	300 cu ft									+	-
	600 "				+	0	0	0	0	+	-
	1200 "				+	0	0			+	0
	1800 "				+	0	0	0	0		
(post-till)	600 cu ft				0	0	+				
	1200 "				0	0	+				
	1800				0	0	+				

a/ + = establishment improved; 0 = no advantage; - = establishment depressed

1/ 75 lbs. 2/ 150 lbs. 3/ 125 lbs.

RESULTS AND DISCUSSION

Dense, massive subsurface soil materials lack the pore spaces which are the basis for good plant-soil-water relations and aeration necessary for plant growth. An earlier report (McCully, Bowmer and Stubbendieck, 1970) summarized the performance of a number of soil additives, and three additional materials (synthetic aggregate fines, processed pine bark and granular reclaimed rubber) were included in the current tests.

Comparison of grass stands from seedings made in 1971 (Table 1) shows some differences in response by location. Both seedings were installed late, but precipitation in Grayson County was more favorable for establishment than in Washington County (Table 2). Under the favorable rainfall in Grayson County all treatments gave grass stands superior to those secured with no treatment; in Washington County, grass stands varied depending on treatment.

Table 2. Precipitation following seeding in Washington and Grayson Counties (U.S. Department of Commerce, 1971).

County	June	July	Aug	Sept.	Oct.	Total
Grayson	0.79	1.82	4.38	4.62	6.98	18.59
Washington	2.56	0.27	2.75	3.45	2.25	11.28

Each of the synthetic polymers (CMC, Gelgard and Reten 210) applied to the surface of freshly tilled soil material this year improved grass stands compared with no treatment (Table 1). Considered over several years at the rates used, these polymers often improved grass stands from seeding, and they have not been detrimental except for the light rate of Reten 210.

Stands from 1971 seedings, as in the past, varied in response to urethane incorporated into the soil. Even though moisture conductivity through dense soil materials is improved by mixing in urethane fibers, grass stands have not consistently improved under field conditions. Urethane is extremely light and difficult to keep in place prior to pulvi-mixing, so the rate applied may vary considerably from the scheduled rate as well as within the treated area.

Gypsum improved stands at both locations in 1971, contrasting with a lack of response in similar locations the year previous. Gypsum usually does not improve soil granulation, especially in calcareous soils as found in Grayson County.

Synthetic aggregate fines, ground bark and reclaimed rubber granules improved stands at all rates of application in Grayson County, but the response in Washington County was variable. All rates of rubber depressed stand establishment, the intermediate rate of bark (60 cu. ft./A) was optimal, and aggregate fines were most effective at either the high (1200 cu. ft./A) or low (300 cu. ft./A) rate of application. Soil moisture available to the seedling grasses varied; wilting occurred sooner in plots treated with the higher rates of these additives.

In a limited number of tests, topsoil appeared to be more effective applied as an overlay, four to six inches thick on a slope face, than mixed with existing soil materials.

The results from these tests show that a number of materials offer some utility in modifying properties of dense soil materials to better support grass plants. Interruption of the soil matrix by physically mixing certain additives or using polymers to coat granules induced by tillage was advantageous in securing a grass stand. The most spectacular increases in stand occurred when topsoil was used to plate a slope face. Present construction practices, often utilizing short haul distances, may permit greater use of topsoiling at considerably less cost than when the common practice was to stockpile and haul relatively great distances.

2. Modification of soil chemical problems. Soil materials more acid than pH 4.5 will not support a plant cover for erosion control. Soil materials have been uncovered during construction in northeastern Texas which were as acid as pH 1.8. These acid materials are found in Weches and associated formations of the Claiborne geologic group (Miller, et al., 1969). The acidity of the surface layer on cut slopes is intensified upon exposure to atmospheric conditions, so the acidity system is self-perpetuating as erosion of the surface material progresses.

a. Reclamation of acid materials - first action.

This test was installed in mid-July on acidic materials under Lakeland-Eustis sands along Interstate 20 north of Tyler. The three lower tiers of the north-facing slope were divided into four replications, on the basis of material color and texture. Agricultural lime was applied at the rates of 30 and 50 tons per acre, on the basis of potentiometric titration. The lime was incorporated into the upper 6 inches of soil using a pulvimixer. Small plots in areas to be seeded with bermudagrass were plated with either sandy or iron-ore topsoil material. Seedings of common bermudagrass (8 pounds per acre), kleingrass (4 pounds per acre) and weeping lovegrass (2 pounds per acre) were applied individually to limed plots. A combination of bermudagrass (6 pounds per acre) and wilmington bahiagrass (10 pounds per acre) also was seeded.

The materials in the test slope varied from shaly to sandy clay in texture, and were gun-metal gray to gray with yellow inclusions to dark brick red in color. The lime requirement based on potentiometric titration ranged from 23 to 36 tons per acre.

The test slope was subjected to heavy rainfall in August, and a portion of the test washed out when water ran over the diversion terraces on the slope. The results here are based on measurements made on the undamaged portions of the slope.

Relatively little difference in the establishment of an individual grass was due to rate of lime in 1971 (Table 3). However, the number of seedlings from a mixture of bermuda- and bahiagrass seeded in limed material or from bermudagrass seeded in either sandy loam or iron ore topsoil (Table 4) was greater for 30 than for 50 tons of lime. Since bermudagrass is quite salt tolerant, it is unlikely that the higher rate of lime was detrimental. Also, the initial establishment on 4 inches of topsoil was greater than on the limed original soil material.

Table 3. Density of grasses from seedlings on acid soil treated with two levels of lime. Road cut along Interstate 20, Smith County, Texas. Seeded July 15, 1971; Evaluated November 20, 1971.

Species	Seeding Rate (lb/A)	Density (seedlings/sq.ft.)	
		30 tons lime /A	50 tons lime/A
Bermudagrass	8	2.3	2.7
Kleingrass	4	1.0	1.4
Weeping lovegrass	2	0.8	1.4
Bermudagrass + Bahiagrass	10		

Table 4. Response of bermudagrass to two lime treatments on topsoil and iron ore topsoil on seedlings along Interstate 20, Smith County, Texas. (seeded July 1971; evaluated November 1971).

Substrate	Density bermudagrass (seedlings/sq.ft.)	
	30 tons lime /A	50 tons lime/A
Sandy loam topsoil	6.7	4.3
Iron ore topsoil	6.4	4.7

b. Reclamation of acid materials - second action (maintenance).

Additional lime was applied in mid-July as a topdressing over existing stands of grass on an adjacent study slope that was limed and seeded in 1968. These earlier lime treatments have been monitored since the test was installed, and acidity readings fell below pH 5.8 for all samples. Six, twelve or twenty-four tons of agricultural lime per acre together with 300 pounds of 16-8-8 fertilizer were broadcast over areas originally treated with either 25 or 50 tons of lime per acre.

The cover of bermudagrass on these test slopes at the time of reliming reflected the acidity status. Plant frequencies, measured as the relative number of square-foot samples containing live plant material, were 80 percent for the original 50 tons of lime, 57 percent for 25 tons, 19 percent for 5 tons and 8 percent for the unlimed control. Comparable measurements were not taken in 1971 subsequent to treatment.

PART B: VEGETATION CONTROL

Tests were installed to control unsightly plants in screenings for headlight glare; to control perennial weeds in asphaltic pavements in northwestern Texas; to compare TCA and TCA/ammate mixtures and to screen experimental materials at College Station.

1. Maintenance of plant screens for headlight glare. A multiflora rose hedge planted in the median of IH 10 eastward from Winnie (THD District 20) to reduce headlight glare has become infested with a number of broadleaf weeds and grasses as well as with a woody shrub, eastern baccharis. These unsightly plants are most prevalent in thin hedge plantings, and are difficult to control with routine mowing operations.

The treatment strategy followed that of 1970; a contact herbicide (cacodylic acid or MSMA sodium cacodylate) was applied followed by a number of materials with pre-emergence potential (Table 5). Individual treatments were applied in duplicate on three dates to a strip four feet wide centered on the hedge row aggregating 0.05 A. Plants present at the time of treatment and for each evaluation were listed.

The plants encountered were a wide assortment of both warm- and cool-season annual or perennial weeds and grasses. Generally, annual plants were controlled more easily by the pre-emergence treatments than were perennials. None of the treatments affected the roses. Simazine, as in 1970, was the most effective material in the January and March treatments. Granules of simazine were somewhat superior to sprays, and the effective treatment life was approximately 20 weeks.

The most common perennial plants were bermudagrass, johnsongrass and showy verbena. Of these, johnsongrass stands were reduced by the heavier rate of Cpd 17623. Also, showy verbena was controlled with simazine, and stands were reduced with Cpd 17623 and VCS-438.

In summary, annual plants in median plantings of roses can be controlled with pre-emergence application of simazine. If growth has started, a contact spray will be necessary. None of the treatments tested controlled johnsongrass or bermudagrass infesting these plantings.

2. Control of perennial weeds infesting asphalt shoulders. Several experimental materials were compared with the mixtures of prometone/fenac/dicamba and bromanil/fenac/dicamba and found less effective with either one or two applications.

Table 5. Relative effectiveness of various herbicides for controlling weedy plants in multiflora rose plantings along highway medians.

Material	Rate (Lb/A ai)	Date of Treatment (Relative control a/ - weeks following treatment)							
		January				March			May
		7	13	19	30	6	12	24	11
Chlorpropham	2.0								4.5
(Furloe 20G)	4.0								4.5
	6.0								5.0
Cpd 9789 (80WP)	1.0								4.5
(Sandoz-Wander)	2.0								5.0
Cpd 13638	2.0	3.0	3.0	3.0	1.0	2.5	1.5	1.0	
(Geigy)	4.0	3.5	3.5	3.0	1.5	3.0	2.5	1.0	
Cpd 17623	1.5								
(Chipman)	3.0								5.0
									5.0
Diphenamid	5.0	3.0	3.5	2.5	1.0	2.5	2.0	1.0	
(Dymid 80-WP)	10.0	2.0	3.0	1.5	1.5	3.0	2.5	1.5	
MSMA/Cacodylic acid	6.0								2.0
(Ansul)	8.0								4.5
Norea	4.0	2.5	3.5	1.0	1.0	2.5	1.5	1.0	
(Herban 80-WP)	6.0	2.0	3.0	2.0	1.0	3.0	2.0	1.0	
	8.0	2.0	3.0	2.5	1.0	4.0	2.0	1.0	
Sesone	4.0	3.5	3.5	3.0	1.5	4.0	3.0	1.0	
(Sesone 90-WP)	6.0	3.0	2.5	2.5	1.0	3.5	2.5	1.0	
	8.0	2.0	2.5	2.5	1.0	3.0	2.0	1.0	
Simazine	2.0	4.0	4.5	4.0	2.0	2.5	2.5	2.0	
(Princep 4-G)	4.0	4.5	5.0	4.5	2.5	3.5	3.5	2.5	
	6.0	4.0	5.0	5.0	2.5	3.5	4.5	2.5	5.0
	8.0								5.0
	12.0								5.0
(Princep 80-WP)	2.0	3.5	4.0	3.5	1.0	4.0	2.5	1.0	
	4.0	4.5	4.5	3.5	1.0	4.5	4.0	1.5	
	6.0	4.5	4.0	4.0	1.5	4.5	3.5	1.5	5.0
	8.0								5.0
	12.0								5.0
Trifluralin	4.0	3.0	3.5	3.0	1.0	2.0	2.0	1.0	
(Treflan 5-G)	6.0	3.5	3.5	3.5	1.5	3.0	2.0	1.0	
	8.0	3.0	3.5	3.0	2.0	4.0	3.0	1.5	
VCS-438 (75-WP)	4.0								5.0
(Velsicol)	8.0								5.0
(3G)	4.0								4.5

a/ 1= 0 - 20% control
2=20 - 40% control
3=40 - 60% control
4=60 - 80% control
5=80 - 100% control

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