SOIL EROSION CONTROL EXPERIMENT

THROUGH THE UTILIZATION OF CHEMICALS

Report 71-3

May 1971

VERMONT DEPARTMENT OF HIGHWAYS

John T. Gray, Commissioner

R. H. Arnold, Chief Engineer

A. W. Lane, Materials Engineer

Report Prepared By

R. I. Frascoia
Research Specialist

TABLE OF CONTENTS

LIST OF TABLES

ABSTRACT

A field experiment was conducted to evaluate two chemicals (Dow Chemical's NC 1556.2L and Gelgard) designed to prohibit soil erosion. The effectiveness of the chemicals used in five different combinations, were compared with areas treated with Vermont's standard treatment of hay mulch with an asphalt emulsion tack and untreated test plots.

Observations were made at various times after application and also during the following spring. The test results indicated that the chemical NC 1556.2L, although not quite as effective as hay mulch and asphalt emulsion, did limit surface erosion and encourage grass growth. The use of the chemical NC 1556.2L could conceivably reduce slope treatment cost due to the ease of application, and its performance indicated that it might be effectively used on raw earth slopes as a temporary erosion control treatment.

INTRODUCTION

The possibility of controlling soil erosion on newly constructed earth slopes with the use of special chemicals has prompted the Vermont Department of Highways to perform a field experiment in cooperation with the Dow Chemical Company in an attempt to evaluate two chemicals which have shown promise in the laboratory as soil erosion inhibitors.

The chemicals are Dow's NC 1556.2L and Gelgard. The purposes of these chemicals are to protect the surface of newly seeded slopes until the growth of vegetation is adequate to prevent erosion, or to act as a temporary erosion control by preventing erosion of newly constructed slopes until the contractor is ready to apply the final slope treatment.

NC 1556.2L is a modified polyacrylamide which reacts with the soil surface and leaves it in a loose, porous, flocculated condition. This encourages infiltration of water which reduces erosion caused by a high rate of surface water runoff. Laboratory tests have indicated that the chemical NC 1556.2L will not prevent sloughing or shear failures caused by subsurface water leeching out of a slope, and it is not conducive to the establishment of permanent vegetation under very dry conditions because a loose, porous soil surface generates rapid soil-water losses by evaporation.

Gelgard is a commercially available Dow polymer and is similar in composition to NC 1556.2L. When sprayed on earth slopes it serves as a binding agent by holding the cover material together and to the soil surface.

LOCATION

The test area selected was on Vermont Interstate Project Norwich-Thetford I 91-2 (7) C/3 at Southbound Station 4301+00 to 4307+00. This area is located 0.528 miles to 0.414 miles south of the Norwich-Thetford Town Line.

APPLICATION PROCEDURE

The soil type in the test area ranged from A-4 sandy silt to an A-2-4 silty sand and would be considered typical of earth excavation materials normally encountered in many Vermont localities.

After completing the dressing of the slopes, which was accomplished by dragging the area with a heavy chain, a hydroseeder was used to apply the normal application of seed (60 pounds per acre), fertilizer (500 pounds per acre), and limestone (2 tons per acre) over the entire cut area.

Fourteen test plots were then staked out for dual applications of seven different treatments. The treatments were as follows:

Test Plots 1 and 14	Hay mulch & Asphalt Emulsion
Test Plots 2 and 13	Hay mulch, NC 1556.2L & Gelgard
Test Plots 3 and 12	Hay mulch & NC 1556.2L
Test Plots 4 and 8	Silva Fiber *, Gelgard & NC 1556.2L
Test Plots 5 and 9	NC 1556.2L
Test Plots 6 and 11	Silva Fiber & NC 1556.2L
Test Plots 7 and 10	Control (no cover)

Test plots 2 through 14 were each 50 feet wide with an average slope length of 35 feet on a 1 on 2 cut slope (1 foot vertical for each 2 feet horizontal). Test Plot 1 consisted of the slope above plots 2 through 12 and was separated from the lower slope by a 12 foot wide berm ditch.

See site layout on next page.

The test plots were covered with their specified treatments according to the following application rates:

2 tons of hay mulch per acre
150-200 gallons of asphalt emulsion per acre
150 pounds of NC 1556.2L polymer per acre
100 pounds of NC 1556.2L polymer per acre when used in combination with other materials
50 pounds of Gelgard per acre
1000 pounds of Silva Fiber per acre

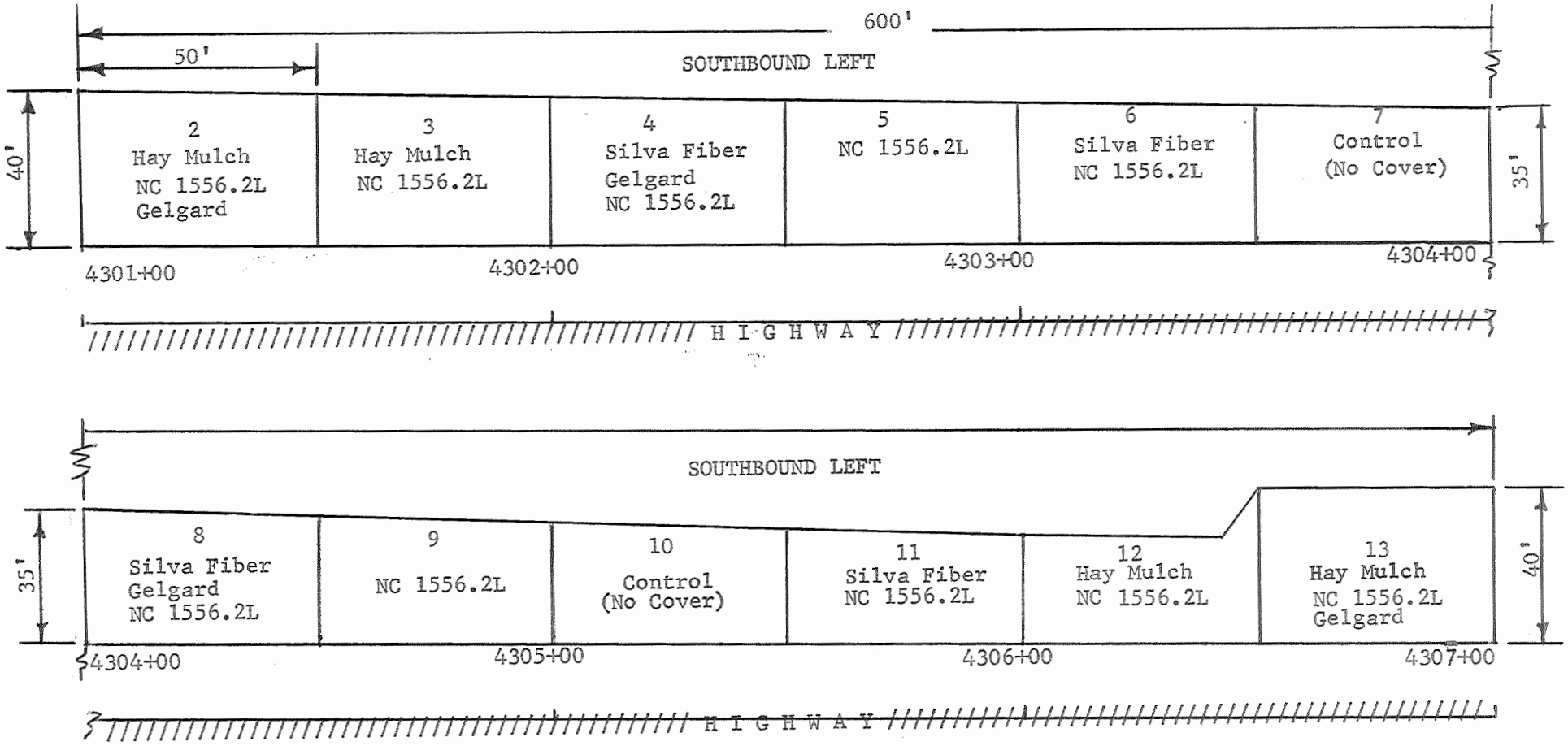
Water was used as a carrier for all chemical treatments at the rate of 4000 gallons per acre.

* Silva Fiber is a commercial wood cellulose mulch

CHEMICAL EROSION CONTROL TEST AREA

NORWICH-THETFORD I 91-2 (7) C/3

Table 1 - Site Layout and Plot Size



Test Plot 1 Located on Slope Above Berm Hay Mulch & Asphalt Emulsion

Test Plot 14 Adjacent to and North of Plot 13 Hay Mulch & Asphalt Emulsion

Scale 1" = 40'

The only difficulties encountered during application of the chemicals involved the treatments which included Silva Fiber. It was necessary to continually agitate this material to keep it in suspension. This in turn would plug the pump intake and severely reduce the distance which the material could be sprayed. This handicap was partially overcome with the use of a second hydroseeder which could be operated with the rear agitator disconnected.

OBSERVATIONS

All field applications were made on October 2, 1970. A light rain started falling about 15 hours after completion of the treatments and continued off and on during the following 4 days.

Field observations made on October 6, 1970 were as follows:

Plot	Treatment	Comments
2	Hay mulch, NC 1556.2L & Gelgard	Washout immediately adjacent to slope pipe. Slight hay movement at other locations.
5	NC 1556.2L	Minor erosion in the form of rivulets on left side of test plot.
6	Silva Fiber & NC 1556.2L	Considerable movement of the Silva Fiber giving it the appearance that additional rain could cause the entire blanket to wash down the slope. The earth slope did not appear to be eroding.
7	Control - no cover	Entirely covered with small rivulets - good indication that most of seed had washed away.
10	Control - no cover	Minor erosion in the form of rivulets on right side of test plot.

All other areas show little or no indication of erosion at this time.

Little or no rainfall occurred between October 6 and October 21, 1970 when the following field observations were made:

Plot	Treatment	Comments
1	Hay Mulch & Asphalt Emulsion	Holding good - moderate to good grass growth.
2	Hay Mulch, NC 1556.2L & Gelgard	Some movement of hay mulch, little grass growth.
3	Hay Mulch & NC 1556.2L	Holding good - good grass growth.
4	Silva Fiber, Gelgard & NC 1556.2L	Holding good - moderate grass growth.
5	NC 1556.2L	Several rivulets - moderate grass growth.
6	Silva Fiber & NC 1556.2L	Some movement of cover - moderate grass growth.
7	Control - No cover	Many rivulets - almost no grass.
8	Silva Fiber, Gelgard & NC 1556.2L	Holding good - little grass growth.
9	NC 1556.2L	Holding good - moderate grass growth.
10	Control - no cover	Few rivulets - no grass growth.
11	Silva Fiber & NC 1556.2L	Holding good - moderate grass growth.
12	Hay Mulch & NC 1556.2L	Holding good - moderate grass growth.
13	Hay Mulch, NC 1556.2L & Gelgard	Holding good - little grass growth.
14	Hay Mulch & Asphalt Emulsion	Holding good - moderate grass growth.

On November 3, 1970, 32 days after the treatments were applied, evaluations of the test plots were made by a chemist and an engineer for Dow Chemical and two engineers of the Vermont Department of Highways. Ratings of 0 to 5 were given each test plot on the extent of erosion and grass germination with a rating of 0 as excellent.

The averaged results are as follows:

Plot	Treatment	Erosion Rating	Grass Rating
1	Hay Mulch & Asphalt	0.2	1.2
2	Hay Mulch, NC 1556.2L & Gelgard	1	1.2
3	Hay Mulch & NC 1556.2L	0	0.5
4	Silva Fiber, Gelgard & NC 1556.2L	0.2	1.9
5	NC 1556.2L	1.6	1.2
6	Silva Fiber & NC 1556.2L	2.1	1.5
7	Control - no cover	3.8	3.8
8	Silva Fiber, Gelgard & NC 1556.2L	0.2	2.9
9	NC 1556.2L	0	1.8
10	Control - no cover	1.6	4.1
11	Silva Fiber & NC 1556.2L	0	2.5
12	Hay Mulch & NC 1556.2L	0	1.4
13	Hay Mulch, NC 1556.2L & Gelgard	0	1.4
14	Hay Mulch & Asphalt	0	1.50

TREATMENTS LISTED IN ORDER OF EFFECTIVENESS AS OF NOVEMBER 3, 1970 EVALUATION

No.	Plots	Treatment	Erosion Rating	Grass Growth Rating	Combination
1	3 12	Hay Mulch & NC 1556.2L	0 0	0.5 1.4	1.9
2	1 14	Hay Mulch & Asphalt Emulsion	0.2 0	1.2 1.5	2.9
3	2 13	Hay Mulch, NC 1556.2L & Gelgard	1 0	1.2 1.4	3.6
4	5 9	NC 1556.2L	1.6 0	1.2 1.8	4.6

No.	Plots	Treatment	Erosion Rating	Grass Growth Rating	Combination
5	4	Silva Fiber, Gelgard	0.2	1.9	5.2
	8	& NC 1556.2L	0.2	2.9	
6	6	Silva Fiber &	2.1	1.5	6.1
	11	NC 1556.2L	0	2.5	
7	7	Control - no cover	3.8	3.8	13.3
	10		1.6	4.1	

The test areas were covered with heavy snow in mid-November and remained snow covered until mid-April. The runoff from the melting snow was very gradual and spring rainfall was somewhat less than normal with most of it occurring the last week of April.

Following are comments from the final evaluation made on May 11, 1971:

Plot	Treatment	Comments
1	Hay Mulch & Asphalt Emulsion	New washout near slope pipe - very minor erosion - fair to good grass growth
2	Hay Mulch, NC 1556.2L & Gelgard	New washout near slope pipe - fair grass growth
3	Hay Mulch & NC 1556.2L	No erosion - very good grass growth
4	Silva Fiber, Gelgard & NC 1556.2L	No erosion - fair to good grass growth
5	NC 1556.2L	Some sloughing has occurred near top of slope - fair grass growth
6	Silva Fiber & NC 1556.2L	No change in earlier movement of cover - fair grass growth
7	Control - no cover	Serious erosion with new sloughing occurring near top of slope - poor grass growth
8	Silva Fiber, Gelgard & NC 1556.2L	Shows signs of movement in surface cover - fair grass growth
9	NC 1556.2L	Some sloughing has occurred near top and left side of slope - good grass growth
10	Control - no cover	Light to moderate erosion - poor grass growth
11	Silva Fiber & NC 1556.2L	No erosion - good grass growth
12	Hay Mulch & NC 1556.2L	No erosion - good grass growth
13	Hay Mulch, NC 1556.2L & Gelgard	No erosion - good grass growth
14	Hay Mulch & Asphalt Emulsion	No erosion - good grass growth

CONCLUSIONS

The results obtained from applications of hay mulch and NC 1556.2L appear to be equal to or slightly better than those obtained from the hay mulch and asphalt emulsion treatments. However, the improvement is not significant enough to consider replacing the asphalt emulsion with NC 1556.2L as this requires an additional step to complete the treatment.

The addition of Gelgard to the hay mulch and NC 1556.2L treatment did not appear to improve performance; while the addition of Gelgard to the Silva Fiber and NC 1556.2L treatment did show a slight improvement in erosion control effectiveness.

Although fair to good results were obtained by adding Silva Fiber to the chemical treatments, it is suggested that the use of this combination be discontinued due to the difficulty of application.

The chemical NC 1556.2L used alone, although not as effective as hay mulch and NC 1556.2L or hay mulch and asphalt emulsion, did limit surface erosion and encourage grass growth. The use of NC 1556.2L in place of hay mulch and asphalt emulsion could conceivably reduce slope treatment costs due to the ease of application; it can be mixed and applied along with the normal application of grass seed, fertilizer, and limestone. The test results also indicate that NC 1556.2L could be effectively used on raw earth slopes as a temporary treatment in anticipation of the final grading and cover treatment.

The chemicals used are still in the experimental stage; therefore, cost comparisons between the test systems and Vermont's standard treatment could not be made. Overall results from the chemical treatments would probably not justify their use in place of Vermont's standard treatment of hay mulch and asphalt emulsion. However, with continued laboratory refinements, chemicals may prove to be fully effective in preventing soil erosion under all field conditions.

October 21, 1970

Test Area

November 4, 1970

Hay Mulch & Asphalt Emulsion

November 4, 1970

NC 1556.2L

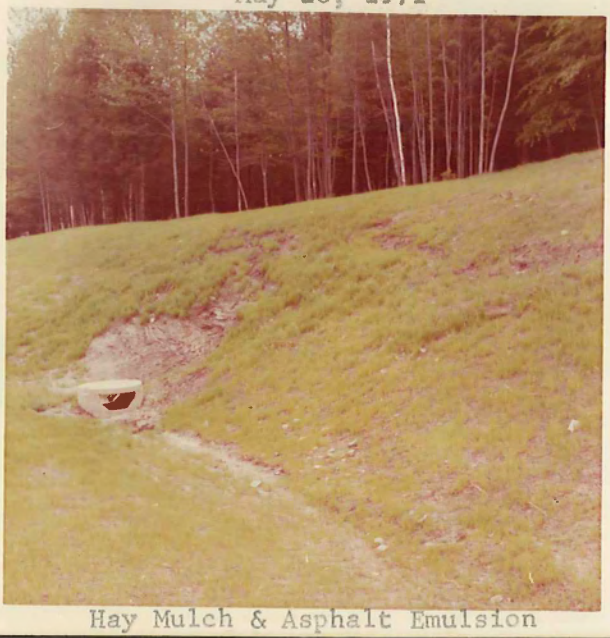
November 4, 1970

Control (no cover)

May 28, 1971

Hay Mulch & Asphalt Emulsion

May 28, 1971



Hay Mulch & Asphalt Emulsion

May 28, 1971

NC 1556.2L

May 28, 1971

NC 1556.2L

May 28, 1971

Control (no cover)

May 28, 1971

Control (no cover)