EVALUATION OF CHEMICAL AND FIBROUS MULCHES

FOR ROADSIDE EROSION CONTROL

By

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CHAPTER I

INTRODUCTION

Oklahoma has over 11,500 miles of highways along with nearly 175,000 acres of roadside area. This roadside area is subject to erosion during and after the initial construction period. The native vegetation is often removed along with the soil that has formed from the parent material. Usually the only entity that is left exposed is the parent material of the removed soil.

It is a practice of the Oklahoma State Highway Department to stockpile the original topsoil. After the major construction has ceased the stockpiled topsoil is then spread on top of the parent material and some type of vegetation is grown on this topsoil.

The topsoil is not in the optimum condition for good vegetative growth. This soil has been handled at least two times by earthmoving equipment. As a result, much of the macrostructure of the soil has disintegrated, leaving much smaller particles exposed to the natural erosion that will commence as soon as the soil is reapplied.

The topsoil, that has been reapplied to the slopes, has no plants to insure a rooting system to help stem the onslaught of the erosion. Also, this soil has been mixed with other soils which may have a high concentration of seeds of undesirable species. This mixing of soils helps propagate the growth of undesirable species on the slopes.

Another problem encountered by the reapplication of the topsoil is the difference in the ability of water to penetrate the topsoil and the parent material. Usually the surface of the parent material is not broken and it forms a very hard crust at the parent material-topsoil interface. As a result, water will penetrate the topsoil relatively easily, but it cannot penetrate the parent material as fast. Since it cannot penetrate the parent material as easily, it can only go downhill. This undermines the very weak structure of the topsoil and it aids in the initiation of erosion.

Many soil binding materials are on the market today. These materials supposedly increase the size of the topsoil aggregates. This, in turn, will decrease the rate of erosion and will increase the possibility of vegetative growth on roadside slopes.

The purpose of this study was to evaluate various soil binding materials. The major objectives of this study were:

1. to study the surface stability and aggregation of soils as influenced by asphalts, elastomer emulsions, and psuedo-plastic materials.
2. to study the effects of various surface mulches such as straw, woodchips, sawdust, asphalt, excelsior, gravel, and a series of organic mulches.
3. to evaluate the effect of the surface mulches on seedling germination.

The research reported herein is divided into two chapters, each manuscript prepared for publication in a professional journal. These manuscripts appear just as they will be submitted for publication, except for minor modifications.

CHAPTER II

AGGREGATION ABILITY OF FOUR SOIL BINDERS ON TWO OKLAHOMA SOILS[1]

Abstract

Four soil binders, Coherex (a resin-in-water emulsion), Curasol (a high polymer plastic emulsion), MS-2 (an asphalt emulsion), and Petroset (an elastomer emulsion) were compared at three concentrations and three lengths of time for their ability to increase the size of soil aggregates. These soil binding agents were applied to two soils, a Teller fine sandy loam (a udic argiustoll), and a clayey soil, Vernon-Lucien complex soil (a typic ustochrept and a typic haplustoll, respectively).

Each of the 72 samples was placed in plastic containers, sprayed with the soil binders, randomized as to the location in each of three blocks in a randomized block design. The samples were exposed to natural weather for designated periods of 45, 90, and 180 days. The samples were treated with 0.5 times the recommended volume after dilution, the recommended volume after dilution, and 2.0 times the recommended volume after dilution. The samples were analyzed for the percent aggregation of the soils at the end of their exposure period.

[1]Article co-authored with L. W. Reed, W. W. Huffine, and R. D. Morrison and to be submitted for publication in the Agronomy Journal.

The MS-2 at the recommended rate and the Coherex at the highest rate gave better results in the aggregation of the Vernon-Lucien complex soil when compared to Curasol and Petroset. The aggregation ability of the MS-2 declined after 90 days exposure and the Coherex declined in aggregation ability after 45 days exposure.

The application of the Coherex at the highest rate to the Teller soil gave best results for the 180 day exposure period. The Curasol gave best results when it was applied to the Teller soil at the highest rate for the 45 day exposure period. There is little advantage in applying the MS-2 to the Teller soil at rates other than the lowest rate when comparing across all exposure periods. The Petroset gave highest aggregation when applied to the Teller soil at the highest rate and when compared across all exposure periods.

Additional Key Words for Indexing: soil erosion control, soil stabilization.

Introduction and Literature Review

Soil erosion along Oklahoma's highways causes considerable damage each year. This erosion usually commences with the construction of the highway and it does not cease when the construction terminates. One group of researchers (5) reported 3:1 backslopes will lose an average of one hundred tons of soil per acre annually and 1:1 backslopes will lose an average of 195 tons of soil per acre per year. Soil loss per unit area is 15 to 20 times greater for roadsides as compared to cultivated fields.

Many efforts have been made to control soil erosion using fibrous mulches (1, 2, 3, 6, 10, 11). There have been many reports on the use of chemical soil stabilizers (2, 3, 4, 7, 9). Fieger (8) reported the use of a high-polymer plastic emulsion. An application rate of 450 kg/ha was effective in controlling erosion for two months.

An asphalt emulsion was used by Eck, et al. (7) for stabilizing sand dunes in the Oklahoma Panhandle. They reported the emulsion did not aid in the germination of plants and it was ineffective one year after application.

A resin-in-water emulsion was used by Lyles et al. (9) to stabilize a highly wind erodible soil. When compared against other soil binding agents they found the resin-in-water emulsion to be most satisfactory in controlling wind erosion.

The objective of this study was to determine the effectiveness of soil aggregation of two soils by four different soil binding agents applied at three rates for three different lengths of time.

Experimental Procedure

The experiment was conducted using two soils, Teller fine sandy loam (a udic argiustoll), and a clayey soil, Vernon-Lucien complex soil (a typic ustochrept and a typic haplustoll, respectively). Four soil binding agents were used. "Coherex"[2], a resin-in-water emulsion, was supplied by Golden Bear Oil Company.[2] "Curasol"[2], a high-polymer plastic emulsion, was supplied by American Hoechst Corporation.[2] "MS-2"[2], an asphalt emulsion, was supplied by Allied Materials Corporation.[2] "Petroset"[2], an elastomer emulsion, was supplied by Phillips

[2]Trade names and company names are included for the benefit of the reader; they do not imply any endorsement or preferential treatment of named products by Oklahoma State University's Department of Agronomy.

Petroleum Company.[3]

Each soil binding agent was applied at three concentrations, 0.5 times the recommended volume after dilution, the recommended volume after dilution, and 2.0 times the recommended volume after dilution. The actual amount applied and the dilution ratio of each soil binding agent is given in Table I.

TABLE I

THE DILUTION RATIO AND THE APPLICATION RATES OF THE SOIL BINDING AGENTS

Soil Binding Agents	Dilution Ratio Agent:Water	Rates of Application in (l/m^2) Based on the Recommended Rates		
		0.5	1.0	2.0
Coherex	4:1	2.28	4.56	9.12
Curasol	20:1	1.14	2.28	4.56
MS-2	3:1	0.80	1.60	3.20
Petroset	24:1	1.14	2.28	4.56

Each soil sample was placed in a plastic pot 11.0 cm in diameter and 7.5 cm deep. They were placed in a randomized complete block design, having three replicates. The first replicate was treated with the soil binding agents on December 20, 1972. Replicate two was

[3]Ibid.

treated January 3, 1973, and replicate three was treated January 10, 1973. The plastic pots with the treated soils were exposed to the naturally occurring weather for periods of 45, 90, and 180 days.

At the end of these exposure periods, the soils in the pots were dried for 72 hours at 80 degrees Centigrade. These samples were sieved through an 8 mm sieve and a 2 mm sieve. A 5 gram sample was taken from those aggregates that were retained on the 2 mm sieve. The samples were vacuum wetted for a period of 72 hours. They were wet sieved for a period of 10 minutes using a machine described by Yoder (12). The sieves were a 2 mm sieve and a 0.25 mm sieve. The results reported are for the aggregates on the 2 mm sieve. The units of measurement were in percent aggregation. The method for determining the percent aggregation is as follows:

$$\text{Percent Aggregation} = \frac{\text{Weight of dry aggregates retained on sieve}}{\text{Total sample weight}} \times 100$$

The resulting experiment thus became a split-split plot where the main plots were in a factorial arrangement of soil by soil binding agent by rate of application of the soil binding agent. The subplot was the exposure period and the sub-subplot was the material retained on the sieves.

A multiple regression analysis was made of the data. The linear and quadratic effects due to days of exposure and rates of application were established, Table II. Three dimensional bar graphs are used to present the data. For the sake of clarity the order of the days of exposure and the rates of application sometimes change.

TABLE II

AN ANALYSIS OF VARIANCE OF THE PERCENT OF AGGREGATION

		Vernon-Lucien Complex Clayey Soil				Teller Fine Sandy Loam Soil			
Source	D.F.	Coherex	Curasol	MS-2	Petroset	Coherex	Curasol	MS-2	Petroset
Replications	2	454.3	1118.1	550.0	1892.6	1909.4	120.7	2142.1	195.2
Rate									
Linear	1	550.9	342.2	124.6	253.4	934.8	4709.3	5906.3**	5983.1**
Quadratic	1	69.2	0.6	2.6	47.0	1084.1	77.1	298.1	62.2
Day									
Linear	1	4679.8*	2702.5*	430.8	149.7	178.6	891.3	2296.6	963.5
Quadratic	1	3296.1*	466.1	1535.3*	481.4	24.4	1862.7	126.4	558.5
Day X Rate									
$rate_L$ X day_L	1	921.0	16.3	874.9	183.2	128.0	2004.1	1606.2	27.5
$rate_Q$ X day_L	1	118.1	5.3	783.6	86.3	1954.1*	10.0	47.8	0.1
$rate_L$ X day_Q	1	307.4	644.3	231.8	423.4	67.7	70.6	5.5	8.9
$rate_Q$ X day_Q	1	90.6	344.7	230.7	753.4	755.9	1341.7	1.1	237.4
Error	16	543.3	352.2	238.9	343.0	428.9	1099.3	529.9	413.6
Means		49.7	26.2	45.8	18.5	60.2	37.3	81.9	27.4
C.V.		46.9	71.5	33.8	99.9	34.4	88.8	28.1	71.1

* Indicates significance at 5% level ** Indicates significance at 1% level

Results and Discussion

In general, there were two highly significant rate linear effects, but there were no rate quadratic effects. There were two significant day linear and two significant day quadratic effects. There was one significant rate quadratic by day linear effect. There may have been other interactions, but the error terms were so large that these interactions were not detected.

Vernon-Lucien Complex Clayey Soil

There were significant day linear and rate quadratic effects in the Coherex treated soil as shown in Figure 1. The average of the percent aggregation at the 45 day exposure period is 25.4, at the 90 day period it is 61.5, and at 180 days exposure the average is 62.2. There is a sharp increase from the 45 day exposure period to the 90 day exposure period. The percent of aggregation levels off from the 90 day exposure period to the 180 day exposure period.

A significant day linear effect of the Curasol treated soil is shown in Figure 2. The percent aggregation average for the 45 day exposure period is 33.3, the average for the 90 day exposure period is 34.7, and the average for 180 days of exposure is 10.3. Apparently there is a large amount of chemical breakdown, after the 90 day exposure period, causing a decrease in the amount of aggregates.

There is a significant day quadratic effect of the MS-2 treated soil, shown in Figure 3. The percent aggregation average for the 45 day exposure period is 43.0. The average increases to 55.3 for the 90 day exposure period, but decreases to 36.9 for the 180 day exposure

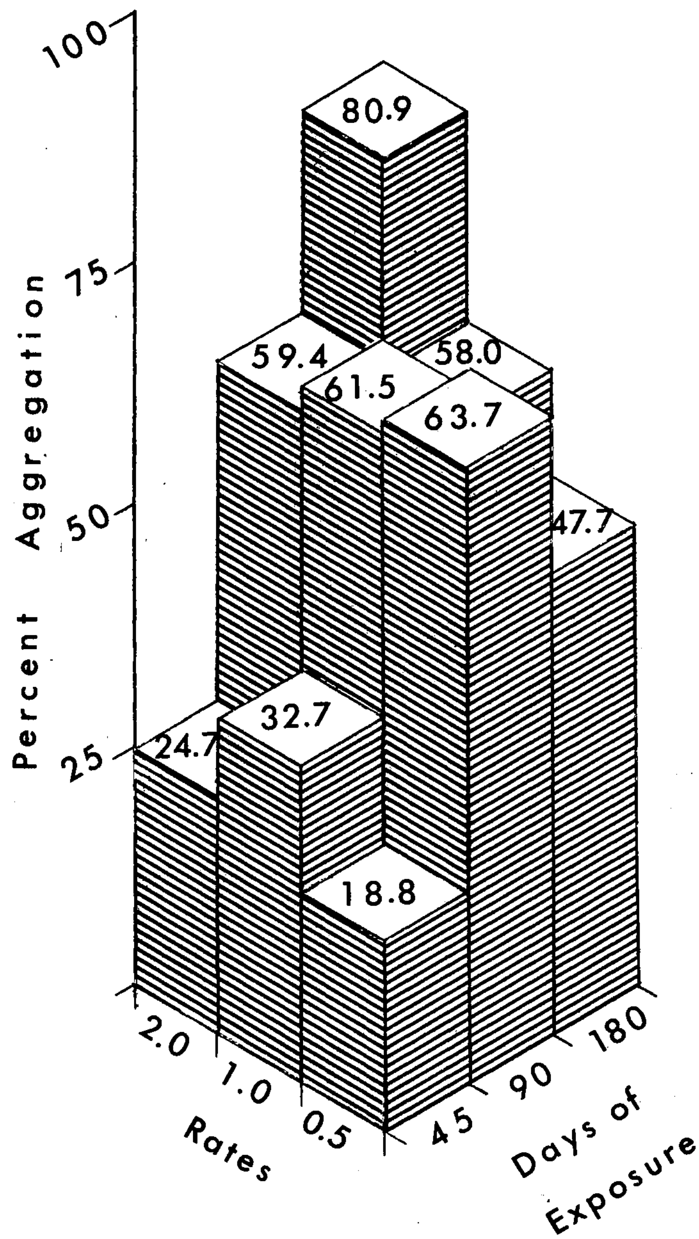


Figure 1. The Percent Aggregation of Vernon-Lucien Complex Clayey Soil Treated With Coherex

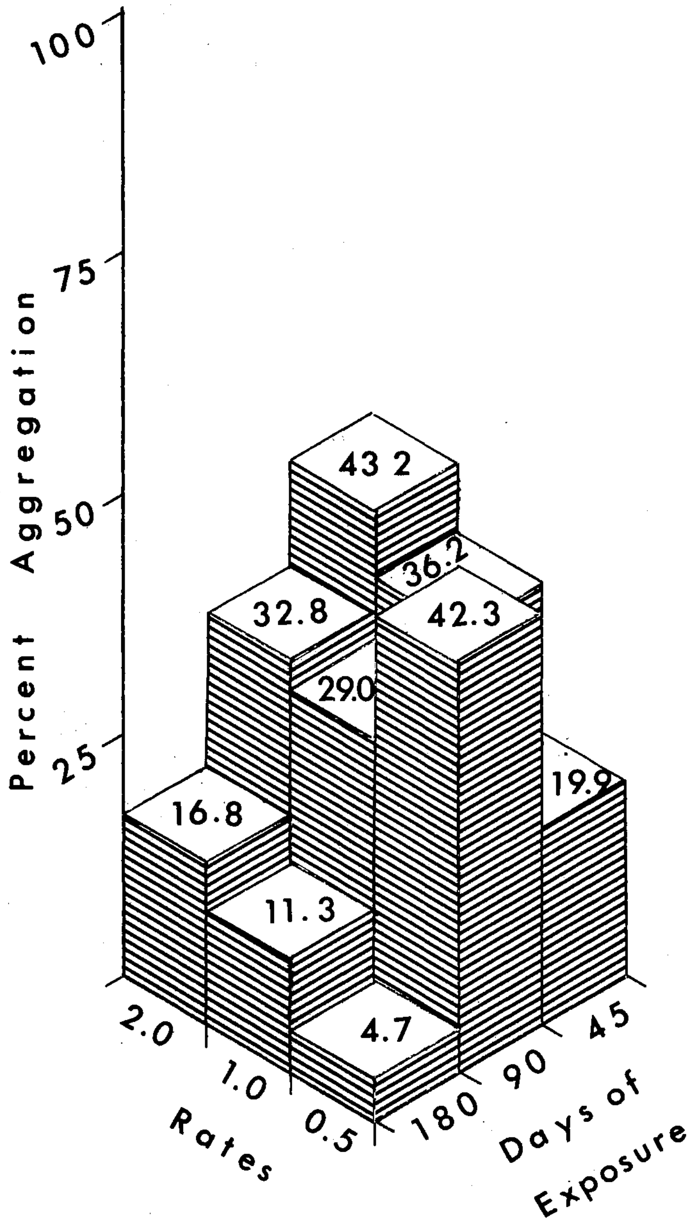


Figure 2. The Percent Aggregation of Vernon-Lucien Complex Clayey Soil Treated With Curasol

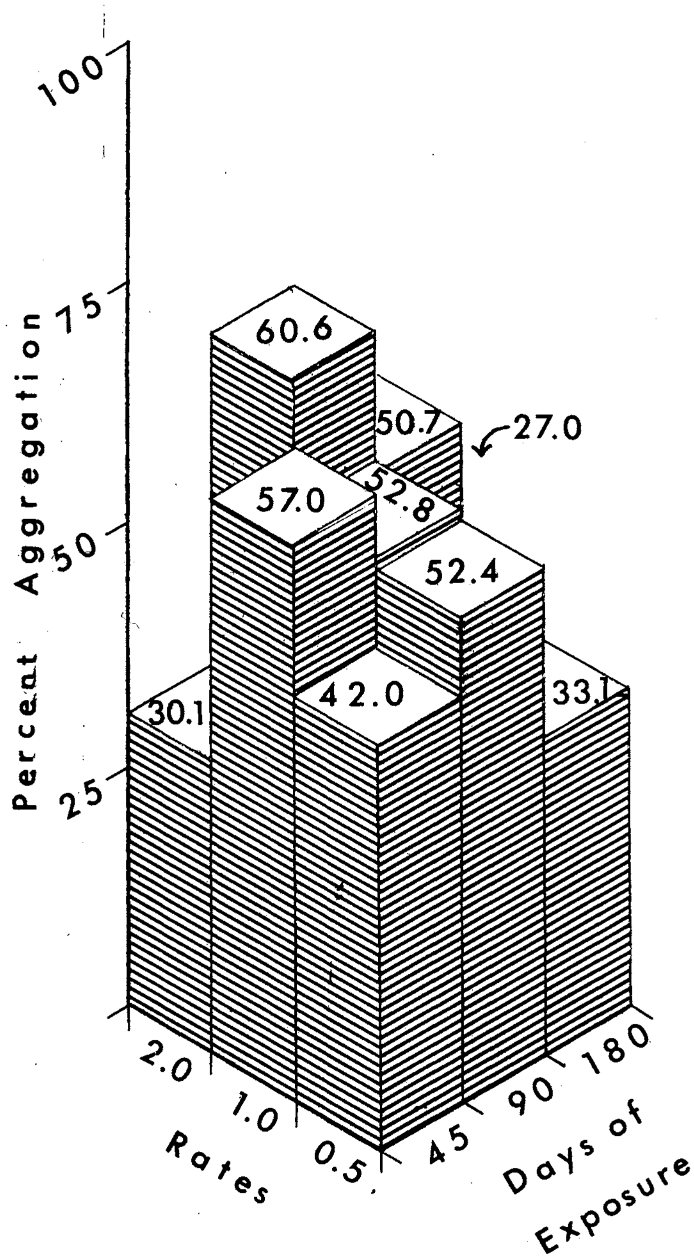


Figure 3. The Percent Aggregation of Vernon-Lucien Complex Clayey Soil Treated With MS-2

period, but decreases to 36.9 for the 180 day exposure period. The MS-2 reaches its maximum aggregation ability at the 90 day exposure period. It is assumed the MS-2 starts decomposing after 90 days of exposure causing lower quantities of aggregates.

The percent aggregation of the Petroset treated soil is shown in Figure 4. There were no significant linear and quadratic effects, and no rate by day interactions.

Teller Fine Sandy Loam Soil

The effect of the Coherex applied to a Teller sandy soil is shown in Figure 5. There is a significant rate quadratic by day linear interaction. The average percent of aggregation for the significant day linear effect is 58.4 for the 45 day exposure period, 58.2 for the 90 day exposure period, and 64.1 for the 180 day exposure period. Therefore, as the exposure period increases the amount of aggregation generally increases.

The percent aggregation of the Curasol treated soil is shown in Figure 6. There were no significant linear effects, quadratic effects, and no significant interactions. However, the Curasol caused relatively high percentages of aggregation for the highest rate and the recommended rate when exposed for 45 days. The amounts of aggregation decreases sharply after 45 days of exposure. This can be attributed to the breakdown of the chemical which yields lesser amounts of aggregates for the 90 and 180 day exposure periods.

A highly significant rate linear effect is shown in Figure 7. The rate of aggregation decreases as the rate of application of the MS-2 increases. The average percentage of aggregates for the lowest rate

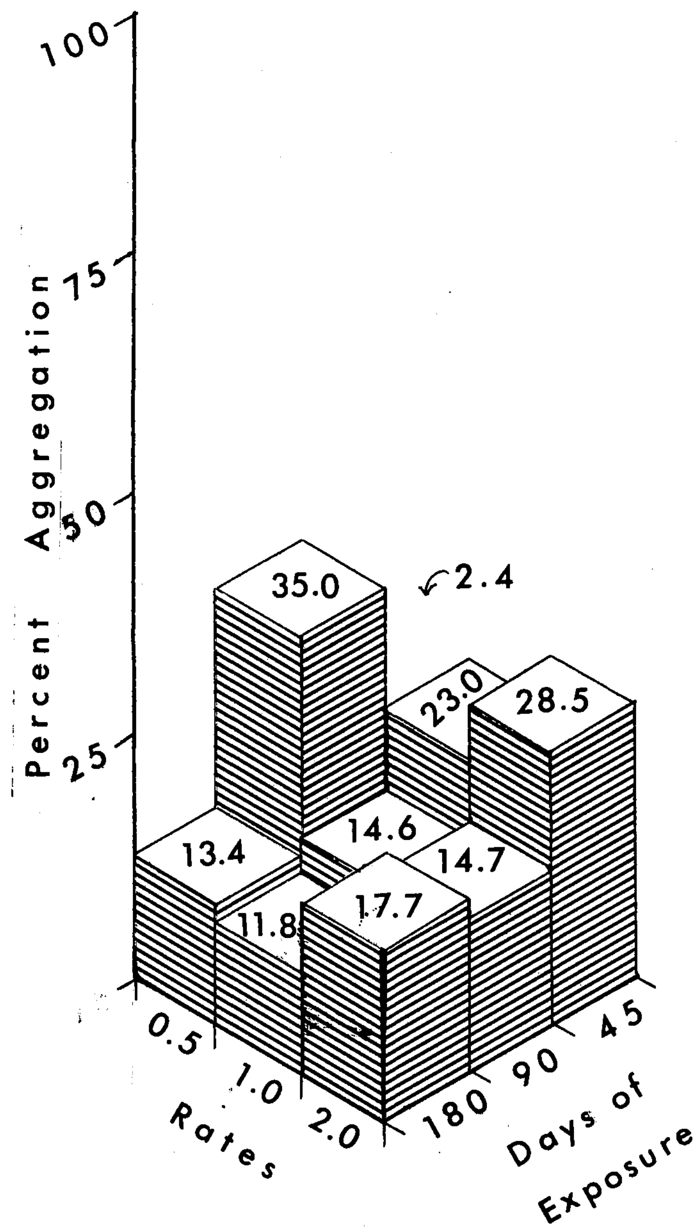


Figure 4. The Percent Aggregation of Vernon-Lucien Complex Clayey Soil Treated With Petroset

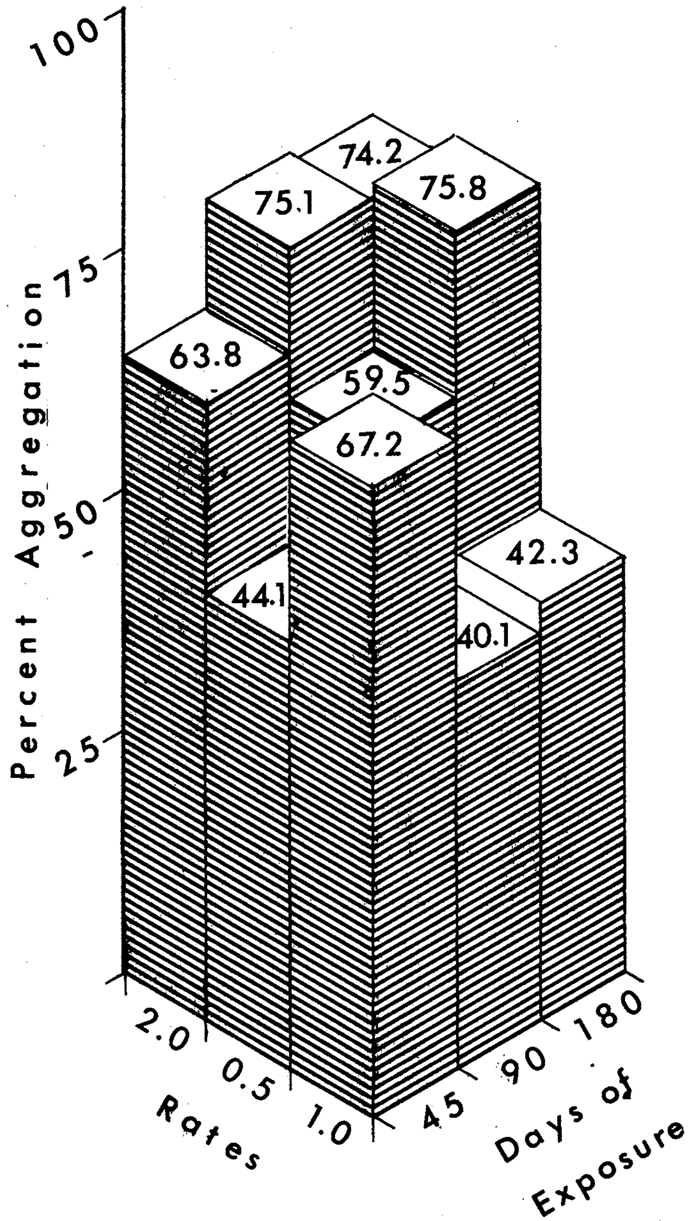


Figure 5. The Percent Aggregation of Teller Fine Sandy Loam Soil Treated With Coherex

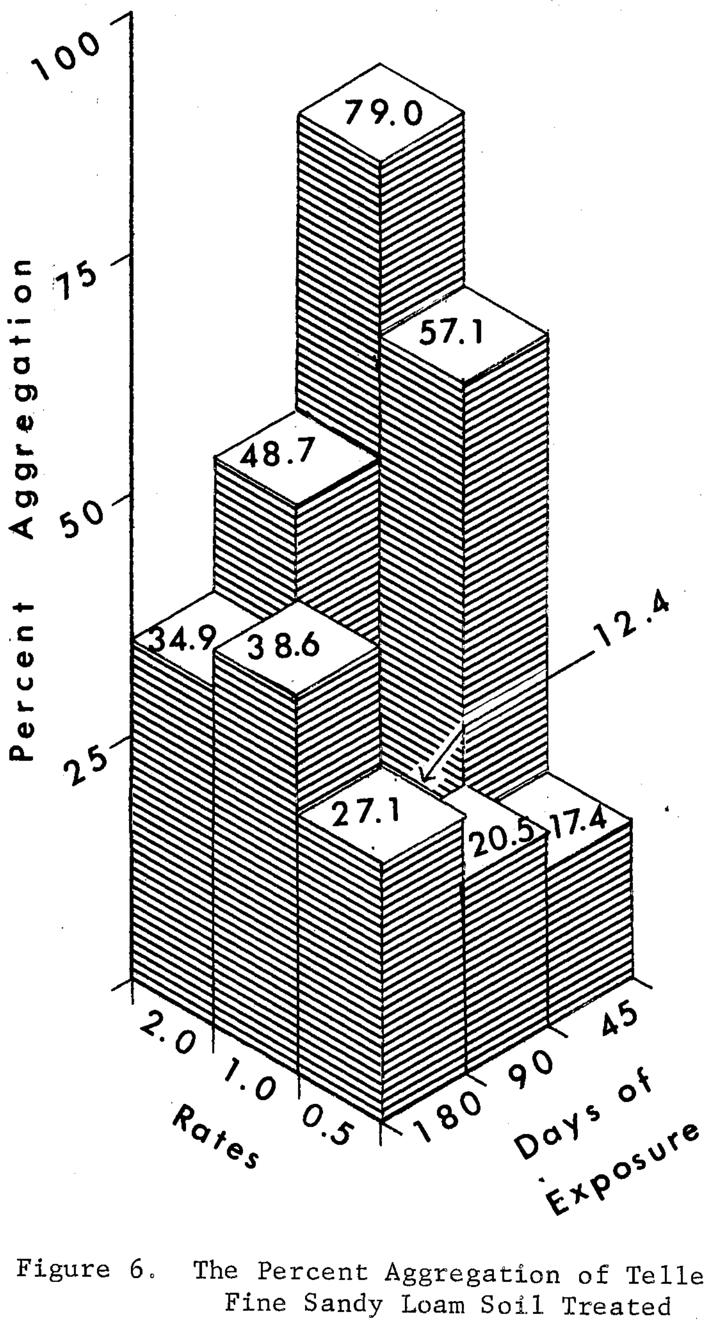


Figure 6. The Percent Aggregation of Teller Fine Sandy Loam Soil Treated With Curasol

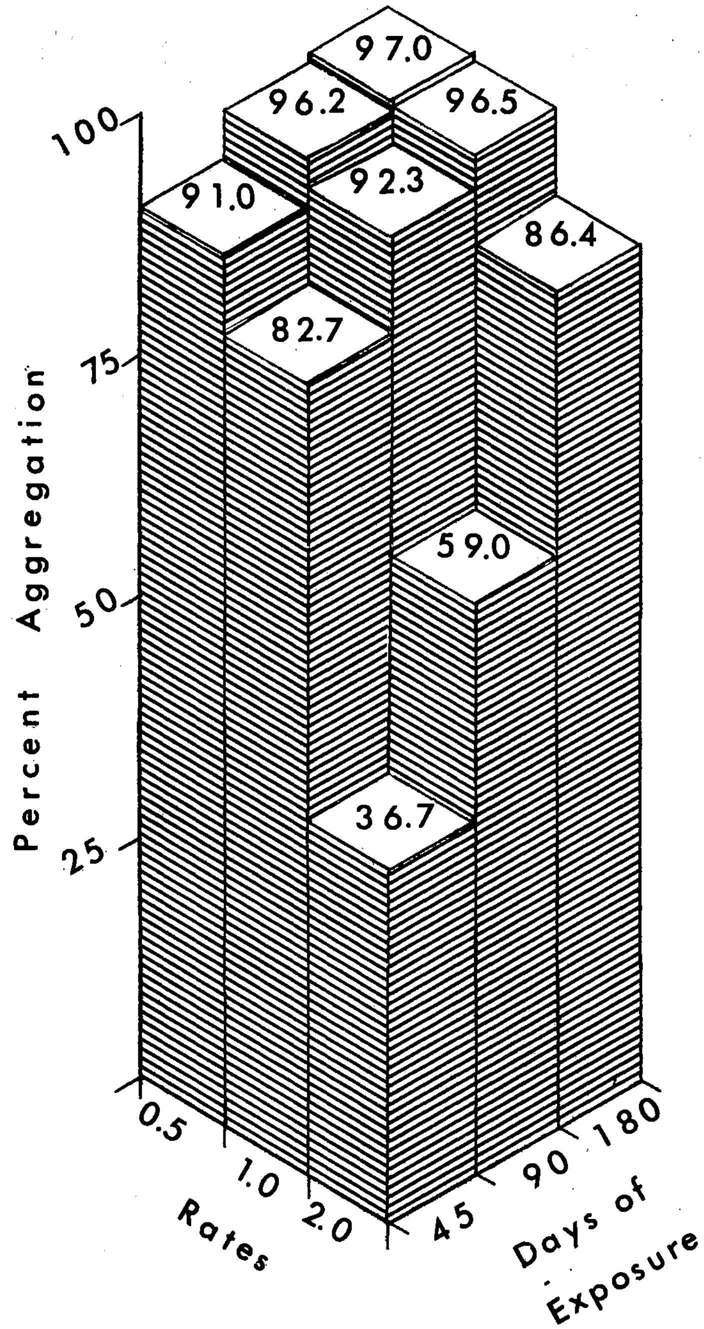


Figure 7. The Percent Aggregation of Teller Fine Sandy Loam Soil Treated With MS-2

is 94.7, the average for the recommended rate is 90.5 and the average for the highest rate is 60.7. There is no advantage in applying MS-2 at quantities greater than the lowest rate over the time length of this investigation. It is speculated that the percent of aggregation for the recommended rate and the highest rate would have been as much as the lowest rate had this investigation been pursued for a longer period of time.

The effect of the Petroset treated soil is shown in Figure 8. There is a highly significant rate linear effect. The average of the percent of aggregation is 12.9 for the lowest rate, 21.4 for the recommended rate, and 48.0 for the highest rate. There is an increase in the percent aggregation as the rate of application increases. However, as the exposure period increases, there is a decrease in the percent aggregation. This suggests a decomposition of the Petroset after 45 days exposure.

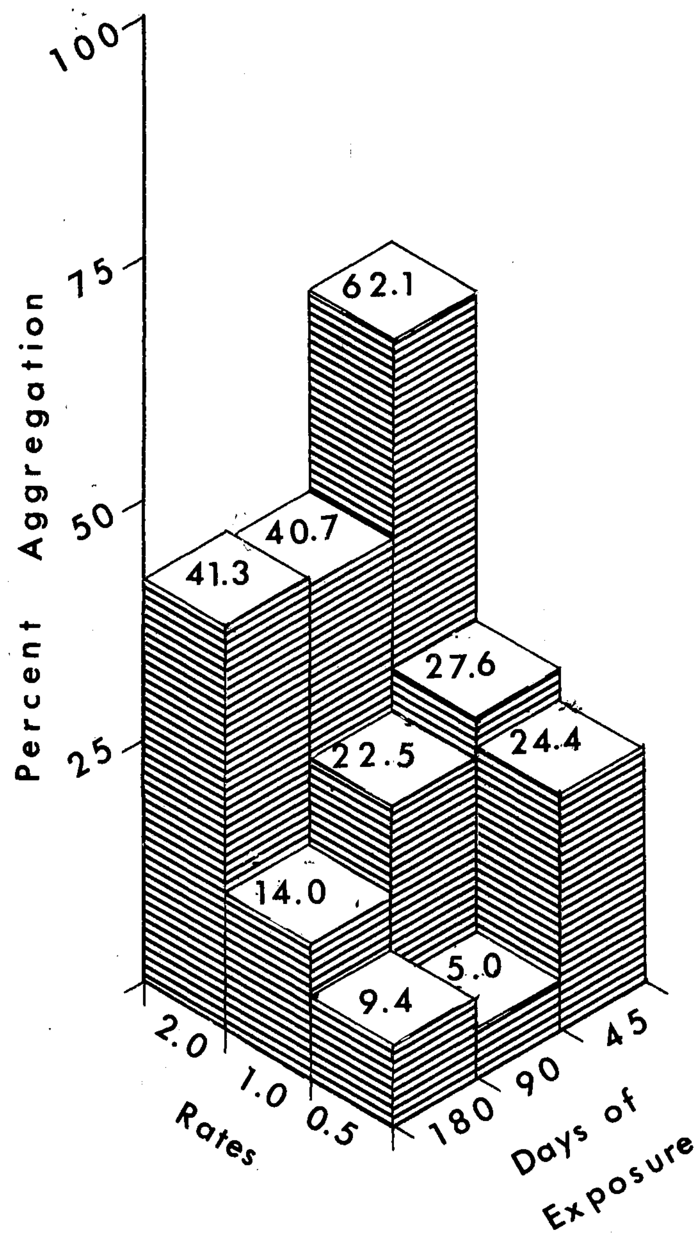


Figure 8. The Percent Aggregation of Teller Fine Sandy Loam Soil Treated With Petroset

CHAPTER III

A COMPARISON OF TWENTY-SEVEN TREATMENTS FOR THE GERMINATION AND GROWTH OF WEEPING LOVEGRASS ALONG HIGHWAY BACKSLOPES[1]

Abstract

A 4:1 backslope was shaped and all vegetative material was removed. The soil studied was a Chickasha loam soil (a udic argiustoll). The backslope was fertilized with 224 kg/ha of 10-20-20 and the soil was disked once to a depth of 10 cm. Weeping lovegrass (Eragrostis curvula (Schrad.) Nees) was seeded at a rate of 8.96 kg/ha. Twenty-six mulches, along with a check (no mulch), were arranged in a randomized block design. There were three replications. Each plot contained a total area of 3.72 m^2. Seventy-five days after seeding 224 kg/ha of 33.5-0-0 fertilizer was applied. Plant population counts were made 120 days after seeding. The results of these data were statistically analyzed and significant differences at the 5 percent level were found. Duncan's multiple range test was used to compare the treatment means.

Applications of 5 cm depth of sawdust plus SS-1 (SS-1 is an asphaltic binder), woodchips, woodchips plus SS-1, and wheatstraw (at 1.27 kg/3.72 m^2) plus SS-1 inhibited the growth of lovegrass and all

[1]Article co-authored with L. W. Reed, W. W. Huffine, and R. D. Morrison and to be submitted for publication in Agronomy Journal.

other plants native to that area. Addition of nitrogen fertilizer was necessary to correct a nitrogen deficiency in the sawdust treated plots. Petroset and Kelgin Q seemed to inhibit the growth of the lovegrass because of some unknown property of the soil binders.

Additional Key Words for Indexing: highway beautification, slope stabilization, soil binders, soil erosion control.

Introduction and Literature Review

Soil erosion on backslopes and fillslopes of highways cause much damage each year to Oklahoma's highways. Therefore, if this erosion can be stopped or brought to a minimum, many dollars would be saved on highway maintenance. One method of minimizing soil erosion is by seeding the slopes with desirable plants and then mulching with some protective material.

Many experiments have been conducted with many different types of mulches (1, 2, 3, 6, 7, 8, 11). Meyer, et al. (10) reported the erosion reducing effectiveness of six rates of straw mulch on fifteen percent slopes. They reported mulch rates of only 0.56 metric ton per hectare and 1.12 metric tons per hectare reduced soil losses to less than thirty-three percent of those from unmulched areas during a series of intense simulated rainstorms. They attributed the reduced soil erosion of the treated plots to the reduced rate of runoff velocity which was approximately one half as great as the velocity of the runoff water on those slopes which had no mulch. However, wheat straw and other mulches that have undesirable plant seed in them tend to introduce weeds and small grain seed which cause reduced grass seedling weights (2).

Wood by-products are being used extensively in erosion control on highway slopes. These consist of woodchips and sawdust (2), excelsior (6), and by-products of the paper industry (2). The use of the wood by-products eliminates the introduction of undesirable plants and provide a new and very useful purpose for these products.

Chemical mulches tend to aggregate soil particles to provide reduced soil erosion. Several reports have been made concerning the use of chemical mulches (2, 3, 7, 8, 11). These mulches are effective when they are used over periods of less than six months (8, 7, 9). Gravel is being used as a mulch. It increases water intake by reducing runoff velocity. This, in turn, decreases erosion (1). Chepil, et al. (4) concluded the larger the size of the gravel, the more that is needed to control erosion.

Methods and Materials

An experimental study was established on a 4:1 backslope that included the A, B, and C horizons of Chickasha loam soil (a udic argiustoll). All vegetative cover was removed from the slope during the shaping process. It was fertilized with 224 kg/ha of 10-20-20. The slope was tilled to a depth of 10 cm with a disk harrow and then seeded with weeping lovegrass (Eragrostis curvula (Schrad.) Nees) at a rate of 8.96 kg/ha.

On completion of the tillage and seeding operation, the slope was mulched with twenty-six mulch treatments and a check (bare ground). These mulches were applied at the rates shown in Table III. The treatments were arranged in a randomized complete block design with three replications. Each plot covered 3.72 m^2. Seventy-five days after

TABLE III

SOIL MULCH MATERIALS AND RATES USED FOR ROADSIDE EROSION CONTROL

Treatment*	Dilution ratio and rate of application/3.72m^2
Aquatain	5.5:1 (water:Aquatain) 2.95 liters of mixture
Baled excelsior	1.24 kg
Bare ground (check)	- - - - - - - - -
Coherex	4:1 (water:Coherex) 16.6 liters of mixture
Conwed Blanket	One layer thick
Conwed fiber	0.5 kg fiber applied with 6.9 liters water
Conwed fiber and emulsion	0.5 kg fiber and 14 g emulsion applied the mixture with 6.96 liters water
Conwed fiber and Kelzan	0.5 kg fiber and 15 g Kelzan applied the mixture with 6.96 liters water
Conwed fiber and Surflo	0.5 kg fiber and 1 liter Surflo applied the mixture with 6.96 liters water
Curasol	20:1 (water:Curasol) 8.32 liters of mixture
Excelsior mat	one layer thick
Gravel (<6 mm diameter)	one layer thick
Kelgin Q	14 g Kelgin Q applied with 6.96 liters water
MS-2	3:1 (water:MS-2) 5.30 liters of mixture
Petroset	25: (water:Petroset) 8.32 liters of mixture
Sawdust	5 cm thick
Sawdust and SS-1	5 cm of sawdust tackified with 7.57 liters of SS-1. Dilution ratio 6:1 (water:SS-1)
Silva fiber	0.5 kg fiber applied with 6.96 liters water
Silva fiber and Kelzan	0.5 kg fiber and 14 g Kelzan applied with 6.96 liters water
Silva fiber and Surflo	0.5 kg fiber and 1 liter Surflow applied with 6.96 liters water
SS-1	6:1 (water:SS-1) 5.30 liters of mixture
Terra mulch	0.5 kg fiber applied with 6.96 liters water
Terra mulch and Kelzan	0.5 kg fiber and 15 g Kelzan applied the mixture with 6.96 liters water
Terra mulch and Surflo	0.5 kg fiber and 1 liter Surflo applied the mixture with 6.96 liters water
Wheat straw and SS-1	1.24 kg wheat straw tackified with 7.57 liters of SS-1. Dilution ratio 6:1 (water:SS-1)
Woodchips	5 cm thick
Woodchips and SS-1	5 cm of woodchips tackified with 7.57 liters of SS-1. Dilution ratio 6:1 (water:SS-1)

*Trade names and company names are included for the benefit of the reader; they do not imply any endorsement or preferential treatment of named products by Oklahoma State University's Department of Agronomy.

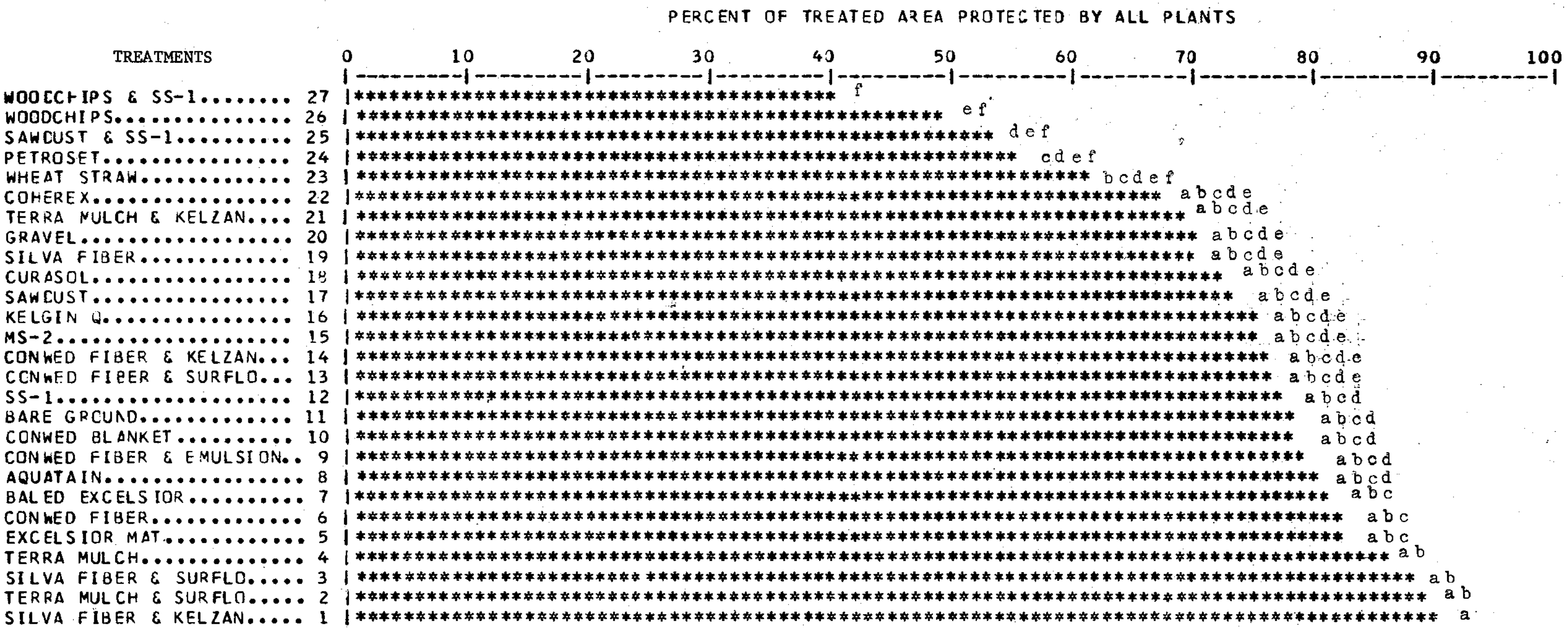
seeding 224 kg/ha of 33.5-0-0 was applied to each plot. Plant counts were made 120 days after seeding by using a 10-point quadrat. Population counts were made on weeping lovegrass and on all other plants that were present. These data were analyzed statistically and the results presented in Figures 9, 10, 11, and 12 are for the percent cover of weeping lovegrass, percent cover of all plants, percent cover of plants other than lovegrass, and the percent of each treated area not covered by plants. Duncan's multiple range analysis was used to compare the treatments.

Results and Discussion

Mulches must serve at least three purposes. They must protect the soil from wind and water erosion, they must allow the root and shoots of emerging plants to penetrate them, and they must not be detrimental to the emerging seedlings.

The lovegrass in the sawdust plus SS-1 plots was yellow 60 days after seeding. The yellow color was indicative of a nitrogen deficiency. It was assumed nitrogen deficiency was caused by immobilization of the available nitrogen by the soil micro-organisms. Therefore, 224 kg/ha of 33.5-0-0 fertilizer was applied. The yellow color was not present at the time of making the plant counts 45 days later.

The lovegrass response of twenty-seven different mulch treatments is shown in Figure 9. Duncan's multiple range test showed five of the twenty-seven mulch treatments were statistically different from the others in that they yielded lower responses of lovegrass cover than the other twenty-two mulch treatments. These five mulches were sawdust plus SS-1, woodchips, woodchips plus SS-1, Petroset, and Kelgin Q. The



(Columns followed by the same letter are not significantly different at the 5% level)

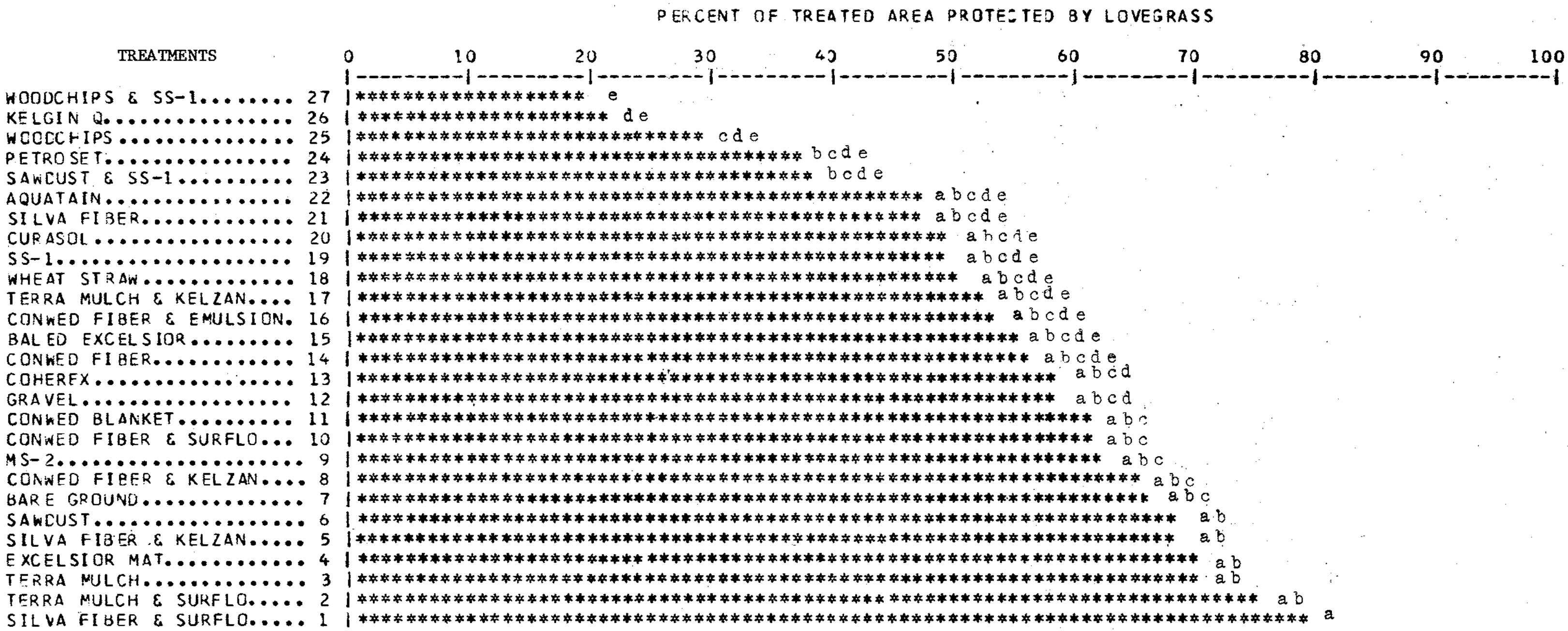
Figure 9. The Response of Weeping Lovegrass to Twenty-Seven Mulch Treatments

SS-1 was used as a tackifier and as a mulch. It was not affecting the plant population of these plots since the SS-1 treatment was among the group yielding the significant plant population.

The sawdust and SS-1, woodchips, and woodchips and SS-1 were applied at a rate that inhibited germination and seedling emergence during the test period. They were applied five centimeters thick. It is suggested that two to three centimeters of depth would allow better germination and seedling emergence. It was noted that the sawdust in relation to sawdust plus SS-1 gave a good response. Immediately after application of the mulches, the plots were subjected to 32 to 48 kilometers-per-hour winds for approximately eight hours. As a consequence, much of the sawdust blew off leaving approximately one to two centimeters of sawdust on the soil surface. Therefore, there was relatively little suppression of growth of the plant seedlings.

The Petroset and the Kelgin Q inhibited the emergence and growth of the lovegrass seedlings. The response of the lovegrass is significantly less when it is exposed to these two treatments than when it was exposed to the other chemical mulches. The reason for the suppression of the growth of the lovegrass by these two mulches is not known.

The combined response of the planted lovegrass and the native plants to the mulch treatments is compared in Figure 10. The wheatstraw, Petroset, sawdust plus SS-1, woodchips, and woodchips plus SS-1 yielded responses that were significantly less than those of the other twenty-two treatments. Seedling penetration of the mulch was suppressed by the wheatstraw, sawdust plus SS-1, woodchips, and woodchips plus SS-1. The rate of application was apparently too high to achieve



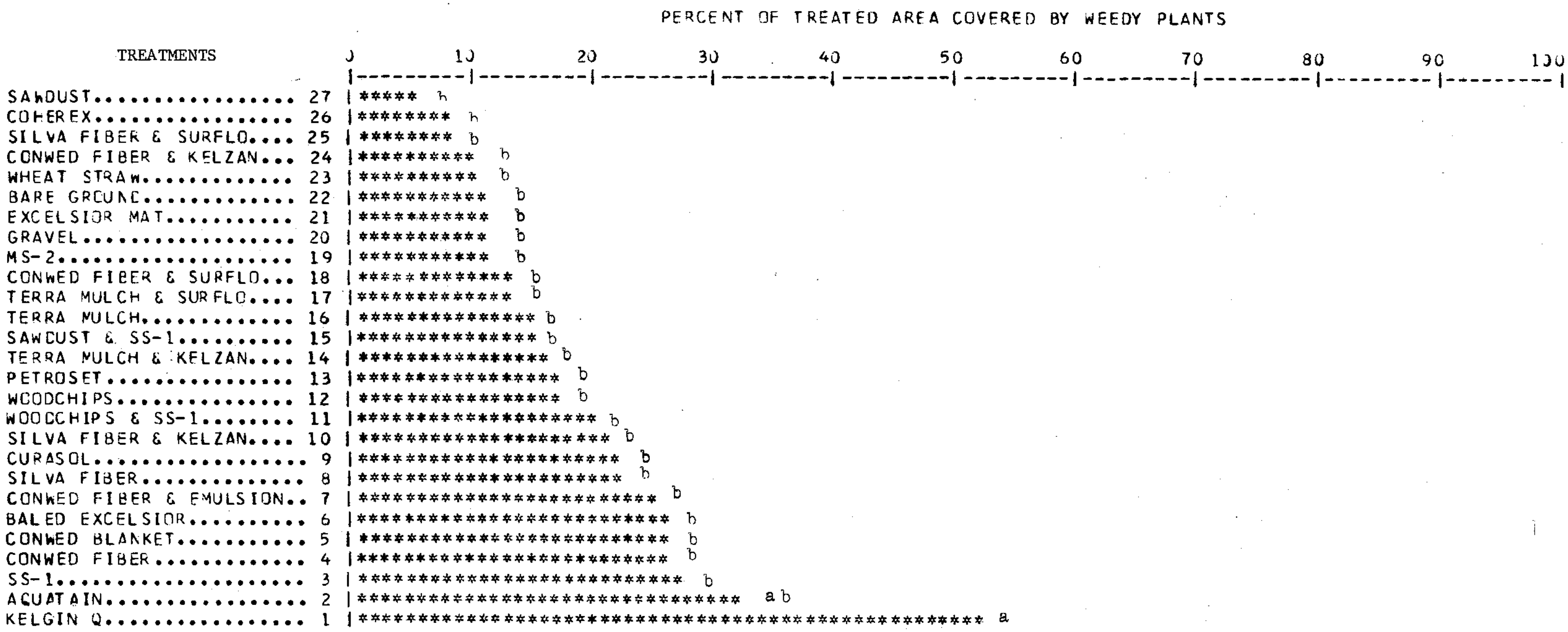
(Columns followed by the same letter are not significantly different at the 5% level)

Figure 10. The Response of All Plants to Twenty-Seven Mulch Treatments

good growth of the lovegrass and the native plants. It is suggested that a rate of one to two cm depth of cover for the sawdust and SS-1, woodchips, woodchips plus SS-1 would allow protection of the soil and also allow emergence of the lovegrass and the annual plants that are native to that area.

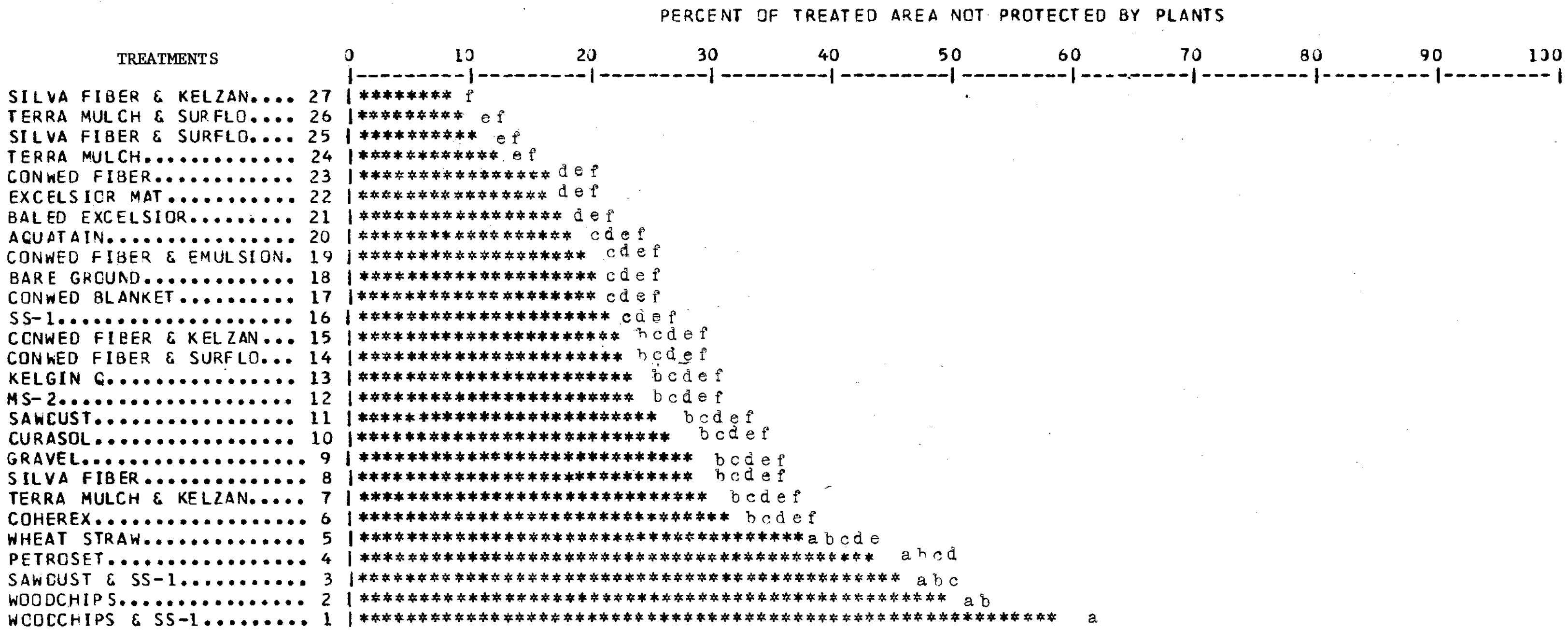
The Kelgin Q and Aquatain treatments yielded significantly greater amounts of plant cover other than lovegrass than the other twenty-five treatments as shown in Figure 11. Apparently the native plants in the plots treated with Kelgin Q and Aquatain grew more quickly than the lovegrass. This establishes a competitive situation between the lovegrass and the other plants with the latter plants taking the advantage.

The amount of treated area not protected by any plants is shown in Figure 12. The wheatstraw, Petroset, sawdust plus SS-1, woodchips, and woodchips plus SS-1 yielded significantly more unprotected treated area than the 22 other treatments.



(Columns followed by the same letter are not significantly different at the 5% level)

Figure 11. The Response of All Plants Other Than Weeping Lovegrass to Twenty-Sevel Mulch Treatments



(Columns followed by the same letter are not significantly different at the 5% level)

Figure 12. The Percent of Treated Area Not Protected by Plants in Response to Twenty-Seven Mulch Treatments

CHAPTER IV

SUMMARY AND CONCLUSIONS

The application of MS-2 or Coherex at the recommended rate gave better results in the aggregation of the Vernon-Lucien complex clayey soil for 180 days of exposure when compared to Cruasol and Petroset. The aggregating ability of MS-2 declined after 90 days of exposure and the aggregating ability of the Coherex declined after 45 days of exposure. Coherex and MS-2 are more acceptable for use on Vernon-Lucien complex clayey soil in that they provided more than twice the amount of aggregation than Curasol or Petroset for the 180 day investigation period.

The application of the Coherex at the recommended rate to the Teller fine sandy loam soil exhibited the greatest aggregation property for the entire 180 day exposure period when compared to the other two rates that were investigated.

The Curasol produced the greatest amount of soil aggregates when it was applied to the Teller soil at the highest rate for the 45 day exposure period.

The low rate of MS-2 application to the Teller soil provides an equally acceptable rate of soil aggregation as the other two rates over the 180 day exposure period.

The highest rate of Petroset yielded the greatest percent aggregation of the rates investigated when applied to the Teller soil and compared for the 180 day exposure period.

In vegetating a slope, it was found that wheatstraw, sawdust plus SS-1, woodchips, and woodchips plus SS-1 were applied at excessive rates that inhibited the germination and growth of weeping lovegrass. These data indicate sawdust should not be applied without a tackifier. Also, it would appear that sawdust immobilizes the soil nitrogen to the point where weeping lovegrass tends to become chlorotic. Application of nitrogen at 224 kg/ha corrected the chlorosis. Petroset and Kelgin Q seemed to inhibit the growth of the weeping lovegrass. The reason for the inhibition is unknown.

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