THE EFFECT OF THE DEGREE OF SLOPE ON RUN-OFF AND SOIL EROSION [1]

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INTRODUCTION

The degree of slope of land has long been considered one of the major factors governing the amount of run-off and soil erosion. Few attempts, however, have been made to establish even the most simple mathematical relationships between the degree of slope of land and the amount of run-off and erosion. While at the university of Missouri, the senior author, in collaboration with Prof. M. F. Miller,[2] reported the results of erosion measurements begun in 1917 on a 3.68 per cent slope. In 1924 additional plots were installed on a 6 per cent and on an 8.25 per cent slope.

The work on these plots, involving three slopes, has been continued at the Missouri station, and a preliminary report has been made by Miller.[3] The chief difficulty encountered in this type of study is that when slopes of different degrees and in somewhat separated locations are chosen, the soil profiles are not identical. The surface soils also are likely to be widely different in absorbing power since they have developed under a different set of conditions. In the work reported in the present paper two methods have been used for determining the effect of slope on the amount of run-off and erosion, in which attempts have been made to eliminate the soil variations referred to above.

METHODS

LABORATORY TESTS

One of the two methods may be termed a laboratory method. A galvanized-iron tank 24 inches wide, 28 inches deep, and 10 feet long was surrounded by heavy framework, as shown in Figure 1. This method was somewhat similar to that reported by Lowdermilk [4] for studying certain questions in connection with forest soils. A silty clay loam soil with a fairly heavy clay subsoil from the agronomy farm was removed in 6-inch layers from a plot exactly the same size as the tank. The soil was placed in the tank in the same order as it existed in the field and was carefully tamped in until it occupied the same volume as it did in the field. Before putting in the soil a 2-inch layer of sand was placed in the bottom of the tank to provide thorough underdrainage, and the excess water was removed through a small drainage tube. The sides of the tank extended 2 inches above the surface of the soil, except at one end where the iron was turned

[1] Received for publication Jan. 19, 1932, issued October, 1932. Contribution No. 214 Department of Agronomy, Kansas Agricultural Experiment Station.

[2] DULEY, F. L., and MILLER, M. F. EROSION AND SURFACE RUNOFF UNDER DIFFERENT SOIL CONDITIONS. Missouri Agr. Expt. Sta. Research Bul. 63, 50 p., illus. 1923.

[3] MILLER, M. F. EROSION AS A FACTOR IN SOIL DETERMINATION. Science (n. s.) 73: [79]-83. 1931.

[4] LOWDERMILK, W. C. INFLUENCE OF FOREST LITTER ON RUN-OFF, PERCOLATION, AND EROSION. Jour. Forestry 28: 474-491, illus. 1930.

down level with the soil to permit run-off. When complete this tank equipment with soil and water weighed about 2.5 tons.

Differences in slope of the soil surface in the tank were obtained by raising one end by means of jackscrews or a differential hoist. A slope of about 20 per cent was as much as it was found possible to give this

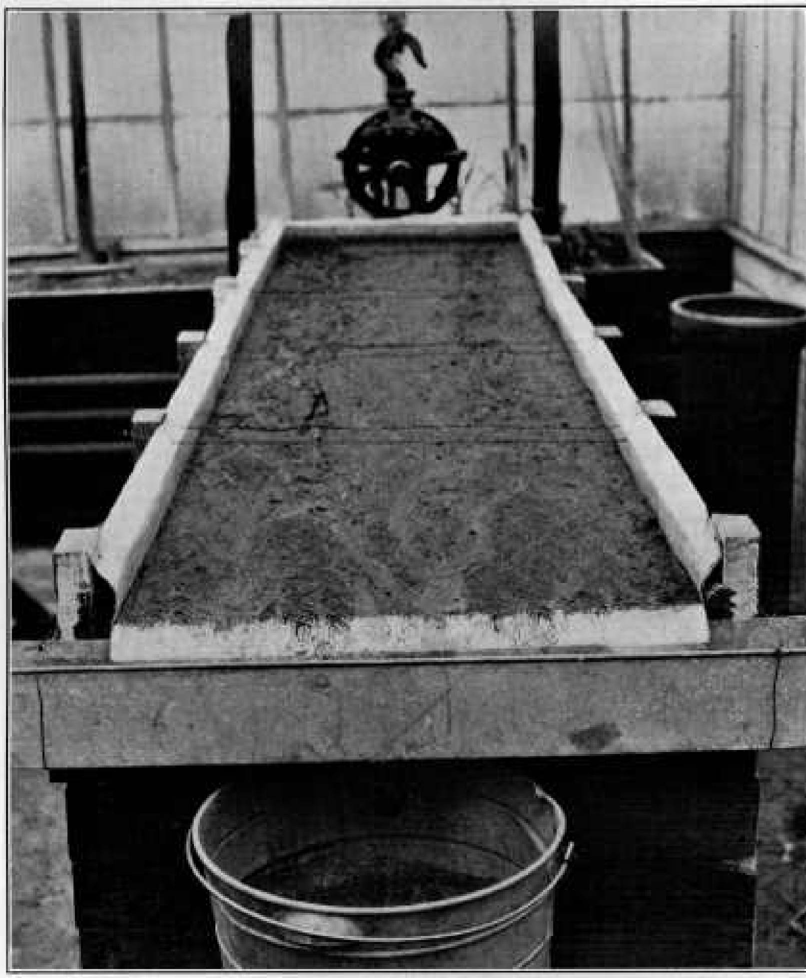

FIGURE 1.—Tank filled with soil and used in greenhouse to determine the effect of slope of the soil on run-off and soil erosion. By raising one end of the tank any desired degree of slope may be obtained

block of soil without throwing undue strain on the tank and framework. A later test, however, was made with a 40 per cent slope.

FIELD TESTS

A second method of determining the effect of slope on run-off and erosion was carried out in the field. In this work an attempt was made to eliminate soil variation by using plots placed at different angles on the same slope. By properly placing the plots, slopes varying from 0° to the maximum slope of the hillside can be obtained. This method is illustrated in Figure 2.

The plot was surrounded by strips of galvanized iron set in the ground to depths of about 8 inches. The iron extended about 2 inches above ground, and the upper edge was turned to prevent bending. At the lower end the edge was turned down about 2 inches until the top was on a level with the soil surface, and the narrow apron thus formed turned down into a small metal gutter which was used for carrying the run-off water and eroded soil into a bucket.

The plots were then leveled crosswise so that there was a slope in only one direction, and the slope lengthwise the plot was made uniform by carefully checking with a line. Some objection might be raised to this leveling process, but fairly deep soils were chosen so that the change in depth of surface soil would not be great and the

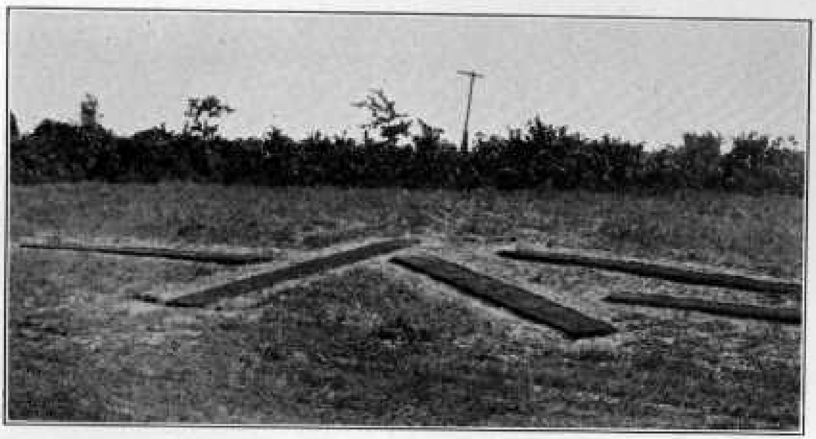

FIGURE 2.—Plots located at different angles on a hillside to obtain different degrees of slope on the same soil. The iron frame used to surround the plots has been removed

subsoil would not be disturbed. Since the plot used was only 34.85 inches wide, it was necessary to transfer only a small amount of soil from the upper to the lower side in order to make the surface level crosswise of the plot. The soil was then spaded to a uniform depth and carefully worked on the surface with a hoe and garden rake so that the amount of loose soil was the same over the entire plot. Care was taken that there were no holes or loose places which would cause irregular settling or uneven absorption of water.

Water was applied to the soil by means of a sprinkling can. The rate of application was carefully timed so that any desired rate of rainfall could be imitated. Several mechanical methods of applying water by means of sprinklers were tried, but it was found that, if carefully used, the sprinkling-can method was the most satisfactory.

The run-off water and eroded soil were collected and weighed, and samples were taken for determining the amount of eroded soil.

EXPERIMENTAL RESULTS

TANK EXPERIMENTS

EFFECT OF SLOPE ON RUN-OFF

The tank of soil was thoroughly soaked with water before any measurements were made. This was done so that the results from different slopes would be comparable. The water was then applied at the rate of 1 inch an hour. By carefully timing the application, it was possible to keep an almost constant application of water. The amounts of run-off and erosion were first determined for a zero slope, or level land. The slope was then increased and the water and soil loss determined. The results of four sets of determinations are shown in Table 1. The average of the four determinations have been plotted on a curve. (Fig. 3.) The most significant thing about these results,

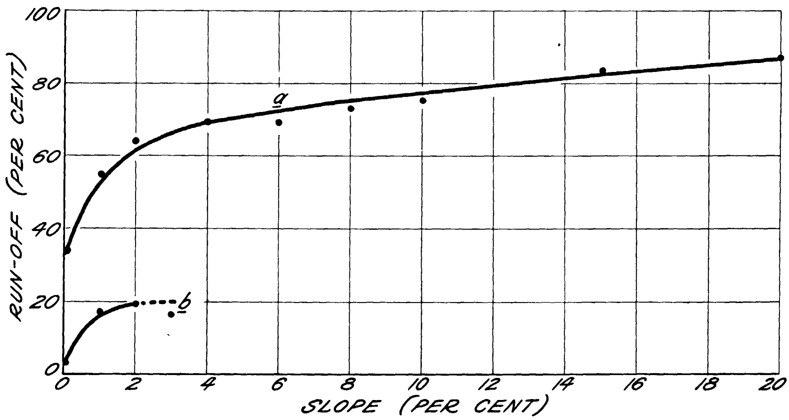

FIGURE 3.—Relation between the degree of soil slope and the percentage run-off: (*a*) Results obtained in Kansas when using soil tank in greenhouse with silty clay loam soil and (*b*) at Spur, Tex., with field plots. Broken part of this curve shows where it might be expected to fall for 3 per cent slope

as indicated by the curve, is the very rapid rise in the rate of run-off as the slope is increased from 0 to 2 per cent, followed by a more gradual rise to between 3 and 4 per cent. After this there is a very much slower rise in the curve. These results seem to indicate that on level land there may be a considerable amount of run-off, but when there is a slight slope the water is less hampered by the very slight depressions and runs off in much greater amounts before it can be absorbed; that is, it will not be held on the land much longer than the duration of the rain. With a still further increase in slope, the increase in run-off becomes relatively less because the water on any slope is running over the land for the entire duration of the rain and thus time is afforded for absorption. Any run-off that may be taking place at the end of the rain will cease within a short time whether the slope is slight or steep.

TABLE 1.—*Effect of slope of tank on run-off water from surface of soil*

[Water applied at rate of 1 inch an hour; size of tank 2 by 10 feet]

Slope	Quantity of run-off water					Average run-off
	Jan. 25, 1931	Jan. 31, 1931	Feb. 21, 1931	Feb. 28, 1931	Average	
Per cent	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Per cent*
0	38.1	----------	20.4	47.2	35.2	33.85
1	57.8	52.2	45.8	70.5	56.5	54.33
2	61.8	65.9	59.5	76.8	66.0	63.47
4	[a] 72.0	70.5	62.8	81.2	71.6	68.86
6	80 8	62.3	72.7	----------	71.9	69.15
8	83.3	70.7	74.7	----------	76.2	73.28
10	82 3	72.6	76.3	81.5	78.2	75.21
15	----------	----------	----------	86.8	86.8	83.48
20	----------	----------	----------	89.9	89.9	86.45

[a] 4.16 per cent slope.

EFFECT OF SLOPE ON SOIL EROSION

An examination of Table 2 and Figure 4 will show that the effect of slope on erosion is almost opposite to that on run-off. The amount of soil removed increased very slowly as the slope was increased up to about 3 or 4 per cent. Then with increasing slope there was a very rapid rise in the amount of soil removed. This shows that with only a very low gradient when the water runs at a relatively slow rate, the soil is not picked up, and the water flows away without carrying much soil, except the lighter particles; but when the slope is increased, the water runs faster, and even though the average depth may be less, a far greater amount of soil is removed. The number of pounds of water required to remove 1 pound of soil decreases rapidly with increasing slope, as shown by Table 2. In a few cases the 0 and 1 per cent grades required a smaller amount of water to remove a pound of soil than did the next higher grades. Further tests are needed to establish this point definitely.

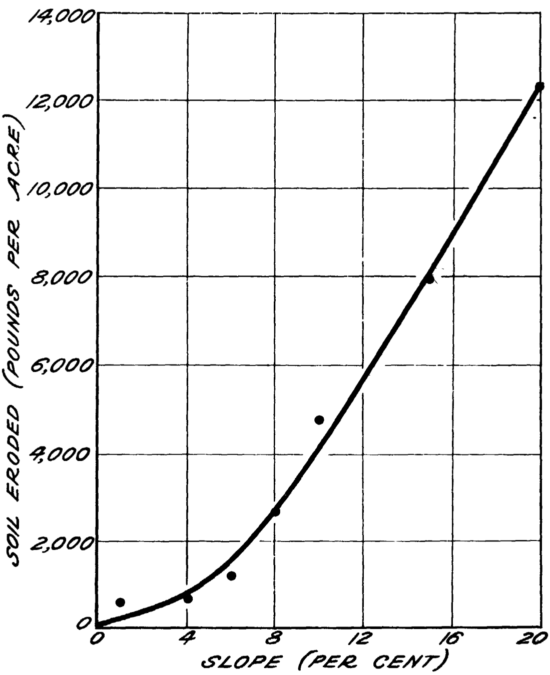

FIGURE 4.—Relation between the degree of soil slope and the quantity of soil eroded from silty clay loam soil in the tank in the greenhouse. Dots show average actual values

In the fall of 1931 the tank was filled with sandy loam with a sandy subsoil from the soil near St. George, Kans., where the field tests were made. The soil was thoroughly soaked with water so that drainage was taking place from the bottom before the readings were started. This made it possible to have the soil in approximately a uniform condition during the time the readings were being made for the various slopes. On November 2 water was applied equivalent to 1 inch an hour. One week later another set of readings was made. At this time the water was applied at the rate of 1 inch in 30 minutes. Tables 3 and 4 give the results obtained.

TABLE 2.—*Soil eroded (pounds) from silty clay loam in greenhouse tank at different percentages of slope*

[Water applied at rate of 1 inch an hour]

Slope	Soil eroded						Run-off required to remove 1 pound of soil
	Jan. 24, 1931	Jan. 31, 1931	Feb. 21, 1931	Feb. 28, 1931	Average	Per acre	
Per cent	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
0	0.037	----------	0.087	0.038	0.054	117.6	651
1	.090	0.429	.287	.265	.267	581.5	211
2	.103	.275	.185	.160	.180	392.0	367
4	[a] .238	.166	.171	.559	.283	616.4	253
6	.587	.260	.722	----------	.523	1,139.1	137
8	1.269	1.002	1.259	----------	1.176	2,561.3	65
10	1.289	3.064	1.751	2.502	2.151	4,684.6	36
15	----------	----------	----------	3.591	3.591	7,821.2	24
20	----------	----------	----------	5.565	5.566	12,122.7	16

[a] 4.16 per cent slope.

TABLE 3.—*Soil eroded and run-off from sandy loam in greenhouse tank at different percentages of slope, November 2, 1931*

[Water applied=1 inch in one hour]

Slope	Soil eroded—		Run-off water		Run-off required to remove 1 pound of soil
	Per plot	Per acre			
Per cent	*Pounds*	*Pounds*	*Pounds*	*Per cent*	*Pounds*
0.5	0.0897	195.4	71.09	68.36	792.5
2.0	.0519	113.1	73.62	70.80	1,417.4
4.0	.0880	191.6	78.74	75.73	895.1
8.0	.4559	993.0	81.53	78.41	178.8
16.0	11.559	25,175.5	81.74	78.61	7.07

TABLE 4.—*Soil eroded and run-off from sandy loam in greenhouse tank at different percentages of slope, November 7, 1931*

[Water applied=1 inch in 30 minutes]

Slope	Soil eroded—		Run-off water		Run-off required to remove 1 pound of soil
	Per plot	Per acre			
Per cent	*Pounds*	*Pounds*	*Pounds*	*Per cent*	*Pounds*
0.5	0.1643	357.8	86.11	82.81	524.1
2.0	.2138	465.7	93.08	89.52	435.3
4.0	.3551	773.4	93.78	90.19	264.1
8.0	2.573	5,604.0	95.59	91.93	37.2
16.0	26.44	57,586.3	95.54	91.88	3.6

It may be seen from the results that the loss of soil was very low up to a 4 per cent slope. Even with the 8 per cent slope only a relatively small amount was lost when the water was applied at the rate of 1 inch an hour. When the slope was doubled to 16 per cent, the erosion was increased to 25.3 times the amount eroded at 8 per cent. With the heavier applications of water the erosion on the 8 per cent slope was increased to 5.6 times the amount of erosion from the lighter application. When the slope was increased to 16 per cent and water applied at the rate of 1 inch in 30 minutes, the erosion was increased to 10.28 times that on the 8 per cent slope. With an application of 1 inch of water an hour on 16 per cent grade the loss was equivalent to 12.5 tons an acre, and with an application of 1 inch in 30 minutes the loss of soil was equivalent to 28.8 tons an acre.

The run-off from this soil was high and did not show as much variation in amount as in previous tests, but did show the same general type of curve as has been found in both tank and field tests.

FIELD DETERMINATIONS

Run-off from Silty Clay Loam

The field determinations were obtained from a plot 34.85 inches wide and 25 feet long or one six-hundredth acre. The soil used was a heavy silty clay loam with a silty clay subsurface. This grades into a heavy clay at 12 to 14 inches. The slope was varied from 0.96 to 5.96 per cent, which was as steep as could be obtained on this land. (Table 5.) The results show the same trend as did the results from the tank, but there was possible a variation of only about 6 per cent in the slope. It may be seen here as in the results from the tank that there is a very great increase in the run-off up to about 2 to 3 per cent. After this, the increase in run-off with increase in slope is much slower.

Table 5.—*Soil eroded from a 1/600-acre plot of silty clay loam on the agronomy farm as related to rate of water application, percentage of slope, and run-off, 1931*

Date	Rate of water application [a]	Slope	Run-off water		Soil eroded	Soil eroded per acre	Run-off required to remove 1 pound of soil
		Per cent	*Pounds*	*Per cent*	*Pounds*	*Pounds*	*Pounds*
June 18	1 inch in 30 minutes	0.96	1.986	0.53	0.0142	8.51	139
	1 inch in 1 hour		14.875	3.94	.0246	14.75	604
	(1) 1 inch in 30 minutes		174.111	46.14	.4889	293.11	356
	(2) 1 inch in 30 minutes		189.656	50.26	.4445	266.5	426
	1 inch in 30 minutes	2.12	35.045	9.29	.1544	92.57	226
	1 inch in 1 hour		86.900	23.03	.2997	179.69	289
	(1) 1 inch in 30 minutes		238.966	63.32	.6337	379.93	377
	(2) 1 inch in 30 minutes		237.697	62.99	.5026	301.33	472
June 17	1 inch in 30 minutes	3.8	69.564	18.43	.5352	320.94	129
	1 inch in 1 hour		120.852	32.03	.4472	268.12	270
	(1) 1 inch in 30 minutes		248.646	65.89	.9540	571.97	260
	(2) 1 inch in 30 minutes		267.006	70.75	.7940	476.04	336
	1 inch in 30 minutes	5.96	77.616	20.57	.4838	290.06	160
	1 inch in 1 hour		128.794	34.13	.7054	422.92	182
	(1) 1 inch in 30 minutes		249.152	66.02	1.2477	748.06	199
	(2) 1 inch in 30 minutes		257.735	68.30	1.3647	818.20	188

[a] Numbers in parentheses indicate different runs, No. 2 followed immediately after No. 1, which gave an application of 2 inches in 1 hour.

A comparison of the data for different rates of application will show that there is a much greater run-off when water is applied equivalent to heavier rainfall. This difference is due mainly to the fact that the absorption of water during a water application equivalent to 1 inch an hour is approximately the same as at a 2-inch-an-hour rate.

EROSION ON SILTY CLAY LOAM

The amounts of soil lost from the plots used in these tests were in some instances not so consistent, especially with the lighter applications of water, as the results from a number of other determinations. There were a few cases in which the amount of eroded soil did not fall at the expected place on the curve. The reason for these slight irregularities seems to be due to the fact that it is usually more difficult to get consistent results with the lower slopes and lighter rainfall because slight variations in the surface have a relatively greater effect than on the steep slopes or with heavy rainfall. The general trend of the results with heavier water applications on this soil, however, were similar to those obtained for the same slopes in the other tests.

RUN-OFF FROM SANDY LOAM

A sandy soil with a sandy subsoil located north of St. George, Kans., 9 miles east of Manhattan, was used for additional tests. The maximum slope here was nearly 12 per cent. At the time these tests were made the soil was extremely dry and no run-off was obtained on the more gentle slopes until about 2 inches of water had been added. (Table 6.) These results followed very much the same trend as those obtained with the tank and with the soil on the agronomy farm. With a 2-inch application of water in 30 minutes after 3 inches had been applied, the increase in run-off was more rapid with the first increase in slope. The run-off from the steeper slopes in this case dropped below that of the intermediate slopes. (Table 6.) No satisfactory explanation can be given for this departure from the regular trend of this curve, but it was probably due to slight irregularities in this sandy soil on the 2 and 4 per cent slopes.

TABLE 6.—*Soil eroded from a 1/600-acre plot of sandy loam as related to rate of water application, percentage of slope, and run-off, St. George, Kans., July 16–17, 1931*

Rate of water application	Slope	Run-off water		Soil eroded	Soil eroded per acre	Run-off required to remove 1 pound of soil
	Per cent	*Pounds*	*Per cent*	*Pounds*	*Pounds*	*Pounds*
1 inch in 30 minutes	0.6	(a)	(a)	(a)	(a)	----------
1 inch in 1 hour		(a)	(a)	(a)	(a)	----------
1 inch in 30 minutes		0.799	0.21	0.0088	5.27	91
2 inches in 30 minutes		179.50	23.78	.2743	164.4	654
1 inch in 30 minutes	2.2	(a)	(a)	(a)	(a)	----------
1 inch in 1 hour		(a)	(a)	(a)	(a)	----------
1 inch in 30 minutes		52.83	14.00	.0746	44.76	708
2 inches in 30 minutes		438.05	58.04	.4547	272.8	963
1 inch in 30 minutes	4.08	----------	(a)	----------	----------	----------
1 inch in 1 hour		----------	(a)	----------	----------	----------
1 inch in 30 minutes		68.43	18.13	.2670	160.07	256
2 inches in 30 minutes		457.54	60.49	3.3664	2,018.3	136
1 inch in 30 minutes	7.72	1.18	.31	.0192	11.5	61
1 inch in 1 hour		2.27	.60	.0227	13.6	100
1 inch in 30 minutes		56.82	15.06	.5819	348.9	98
2 inches in 30 minutes		359.72	47.67	7.1769	4,302.9	50
1 inch in 30 minutes	11.36	2.80	.74	.2943	176.4	10
1 inch in 1 hour		8.12	2.15	.3702	221.9	22
1 inch in 30 minutes		77.68	20.59	3.9212	2,291.0	20
2 inches in 30 minutes		355.82	47.14	28.881	17,315.6	12

[a] None.

Erosion on Sandy Loam

The soil eroded from the plots when water was applied heavily is represented in the curve in Figure 5. The type of curve obtained on these field plots is very similar to that obtained with the tank and with the silt loam soil. There is a very slow and gradual rise in the amount of erosion up to about 3 to 4 per cent slope, when the curve rises rapidly and erosion becomes exceedingly severe with very rapid rise in the curve at about 7 per cent slope and greater. A 2-inch rain falling in a 30-minute period caused seven times as much erosion on this soil on the steeper slopes and about thirty times as much on the gentle slopes as a 1-inch rain falling in the same time. This difference is due partly to the fact that sand grains are difficult to move, but when sufficient water is running over the surface they are picked up readily and carried down the slope.

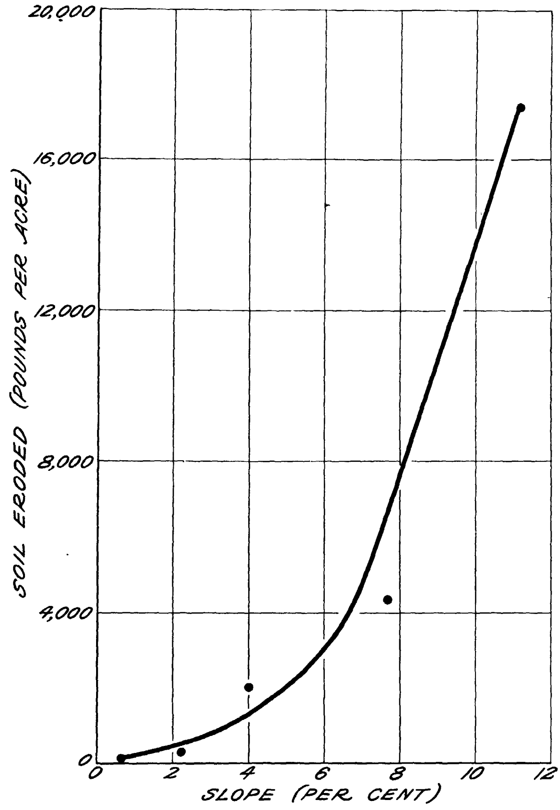

Figure 5.—Relation between the degree of slope and the quantity of soil eroded from a sandy loam soil to which water was applied at the rate of 2 inches in 30 minutes after 3 inches had been applied

SOIL EROSIVENESS

By comparing the amount of erosion shown in Table 2 with that in Table 3 it will be seen that there are some striking differences in the rate of erosion for silty clay loam and sandy loam soils. For the lower slopes, 2 to 8 per cent, there is a much higher erosion from the silty clay loam soil. The 8 per cent slope on the silty clay loam soil gave 158 per cent increase over the amount eroded from the sandy soil, whereas the 16 per cent slope on the sandy soil gave an increase of 222 per cent over the amount lost from the 15 per cent slope on the silty clay loam soil. Thus the relative erosiveness of the two soils was completely reversed simply by changing the slope of the land.

These figures show the difficulty of classing some soils as erosive and others as nonerosive on the basis of certain physical constants as has been attempted by Middleton.[5] It would appear from these

[5] Middleton, H. E. properties of soils which influence soil erosion. U. S. Dept. Agr. Tech. Bul. 178, 16 p. 1930.

data that erosiveness is not merely a specific property of the soil itself, but the conditions under which the erosion takes place must also be given consideration. Middleton found in the soils with which he worked that the nonerosive soils were low in sand and high in colloids. In the work herein reported, the relative erosiveness of a sandy soil has been found to depend largely on the degree of slope and the rate of rainfall.

In comparing the silty clay loam with the sandy soil it will be seen that with the lower slopes the light soil grains may be carried away from the silt loam, when there is not sufficient speed to the water to pick up the soil particles in the sandy soil. With increase in the slope to 16 per cent the water flows with enough force to carry the larger and heavier particles from the sandy soil; consequently the erosion is greatly increased and far surpasses that from the silty clay loam soil.

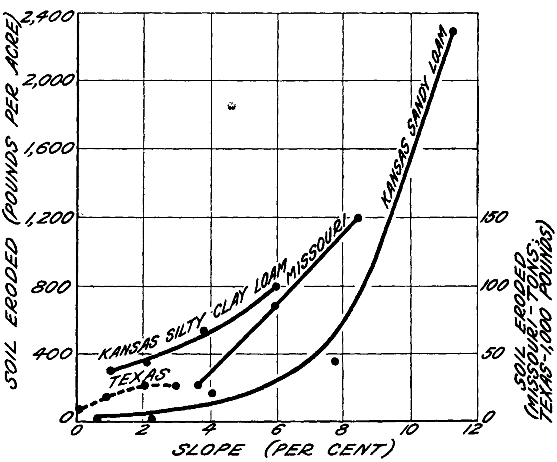

FIGURE 6.—Comparison between soil-erosion results obtained in Kansas with artificial watering and those obtained as annual averages at Columbia, Mo., and Spur, Tex., under natural conditions and on larger plots

The amount of water required to remove 1 pound of soil on the 8 per cent slope was 65 pounds for the silty clay loam and 179 for the sandy loam, but on the 15 per cent slope on the silty clay loam it required 24 pounds, and on the 16 per cent slope on the sandy soil only 7 pounds of run-off water were required to remove 1 pound of soil.

It would therefore seem necessary to take into consideration the degree of slope, the rate of rainfall, and possibly other factors before the relative erosiveness of two soils can properly be expressed.

APPLICATION OF RESULTS

The question naturally arises as to whether the results obtained by these methods on small plots with water applied artificially, can be applied to field conditions. Some comparisons have been made with results from other stations. In Figure 6 will be found a curve showing results from the Missouri station at Columbia reported by Miller.[6] These results give almost a straight-line curve, but this follows the general direction of the curve for the sandy loam soil used in these tests for the same degree of slope. When differences in location and methods are considered, this probably could be regarded as a reasonably good agreement. Since in the Missouri tests only three points on the curve are represented, it is impossible to show the trend for a wide range of slope since it has been found in the present work with small plots that the greatest increase in erosion is

[6] MILLER, M. F. Op. cit.

to be found at about the point of the lowest slope used in the Missouri tests. A similar comparison was attempted with the results obtained by Conner, Dickson, and Scoates [7] at the Spur, Tex., station. Their results were obtained on slopes ranging from 0 to 3 per cent. This was below the point of greatest increase found in the tests herein reported. The chief difference in the results is the fact that in Texas a large increase in erosion was obtained with the 1 per cent slope as compared with the zero slope. The increase from 1 to 3 per cent slope was much less marked. Another difference in methods is that the different slopes in Texas were produced by artificially adjusting some of the slopes for the entire length of the plot, whereas in the present work the natural slope was used for the length of the plot and the only adjustment of the surface was in leveling across the plot, which in most cases did not disturb much soil.

The amount of run-off obtained in the Texas experiments is represented by the curve *b* in Figure 3. This curve is very similar to that obtained with the tank, except that the 3 per cent slope has given less run-off than has the 2 per cent slope. Conner and his coworkers state that this is probably due to the building up of the soil to obtain the 3 per cent grade.

It would seem from these few comparisons at least, that the methods herein reported give results comparable with those obtained on larger plots and conducted under conditions of natural rainfall. They have the distinct advantage of affording opportunity for a large number of repetitions of comparable conditions as well as the possibility of studying a great number of different conditions bearing on a given problem, and in addition to this may be used for a wide variety of problems. Permanent plots placed at different angles on a hillside could be used to excellent advantage for determining the effect of slope under normal rainfall conditions extending over a long period.

SUMMARY

Determinations of run-off and erosion were made by means of water applied to soil artificially to simulate rainfall.

In one case a tank, which could be tilted so as to vary the degree of slope of the surface, was filled with soil and used to study the effect of slope on run-off and erosion.

In another test the plots were placed at different angles on a hillside so that the slope ranged from level to that of the steepest part of the hill. By properly locating the plots large variations in soil profile could be avoided.

The results from the two methods checked very well and indicate that the one to be used will depend on the type of problem to be studied.

The run-off was found to increase rapidly as the slope increased from zero to about 3 per cent grade. The increase in run-off was then very slight for each per cent of increase in slope.

The soil eroded increased very gradually until the slope was about 4 per cent, then the increase was found to be more rapid up to about 7 or 8 per cent, after which there was a still greater increase in the rate at which the soil was removed from the plots.

[7] CONNER, A. B., DICKSON, R. E., and SCOATES, D. FACTORS INFLUENCING RUNOFF AND SOIL EROSION. Tex. Agr. Expt. Sta. Bul. 411, 50 p., illus. 1930.

The amount of run-off water required to erode 1 pound of soil decreased rapidly as the slope increased from 1 per cent up to about 10 per cent, after which the decrease was gradual and slight. In some cases the water required to erode 1 pound of soil was less for the 0 and 1 per cent slopes than for a 2 per cent slope.

Soil erosiveness is shown to depend not merely on the physical properties of the soil, but also on the degree of slope and possibly on several other factors. A silty clay loam gave greater erosion on the lower slopes whereas a sandy soil gave more erosion than did the silty clay loam on steep slopes.

The results obtained on large plots in Missouri and Texas have been shown to correspond reasonably well with the results obtained in these tests. This would tend to indicate that small plots having water applied artificially may be used for studying a large number of problems in connection with soil erosion.