

Runoff and Soil Conservation Practices

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ATTEMPTS to determine the effect of conservation practices are usually designed to give the effect of each practice separately. From these individual effects, attempts are made to approximate the total effect on a larger area where all practices are involved. In making this attempt many approximations and estimates are required.

At the Blacklands Experimental Watershed near Waco, Texas, facilities are available to study the effects of combined practices on rates and amounts of runoff and to a smaller degree on soil losses. The experimental layout has two quite similar areas of about 300 acres each with each further divided into smaller areas. Runoff measurements are available from each of these areas and soil loss measurements from some of them.

During the period 1937 through the crop year 1942, ordinary farming practices with straight rows were used on all areas. In the fall of 1942 an improved crop rotation was started, some areas were retired from cultivation to pasture and meadow land, and sloping cultivated land was terraced on one of the 300-acre areas (Y). The other 300-acre area (W1 and W2) was continued with the ordinary practices (Fig. 1). By comparing the two areas before and after treating one of them, the effect of conservation practices can be determined.

The ordinary farm practices in this area called for approximately one-half the cultivated land in cotton, one-fourth in corn, and one-fourth in oats, sorghum and other crops each year. A small amount of meadow and pasture was also included in most farms. With the improved rotation started on the Y area in the fall of 1942, the general plan was one-third of the cultivated land in cotton, one-third in corn, and one-third in oats overseeded with Hubam clover. Some of the steeper areas had a two-year rotation of corn followed by oats overseeded with Hubam clover, and some good foot-

slopes had a two-year rotation of Hubam clover harvested for seed, followed by cotton or corn. In addition a considerable amount of land has been retired from cultivation to pasture. The terraces used on the Y area were all variable-grade terraces with terrace outlet ditches sodded with Bermuda grass. To retain the smaller natural watersheds, terraces are somewhat shorter than is common practice in this area (Fig. 2).

As the comments on runoff rates and amounts will be limited to five areas, details of the crop distribution for these areas are given in Table 1 for the year 1942 before any changes were made, and for the year 1947 after the conservation plan had been in operation several years on the Y area. The increase in the acreage of pasture and meadow has been made largely by the reduction in the cotton acreage.

The years 1937, 1938, and 1939 were very dry years with practically no runoff. A number of runoff periods of considerable magnitude occurred before the conservation practices were established on the Y area in the fall of 1942. Work was greatly curtailed in July 1943 and runoff records are available for only three stations during the wet years 1944 and 1945. Since 1945 some stations have been reestablished and, although the record from these reestablished stations is short, some reference will be made to it.

The effect of the land changes on peak rates of runoff has been quite well determined for the 132-acre area Y-2 (Fig. 3).¹ From the record through 1945 conservation practices have resulted in lower peak rates of runoff but the effect appears to be slightly less for the larger floods. On the heavy black clays of the area during long storms or rainy periods a condition is reached where almost all rainfall appears as runoff. Under these conditions only those practices which reduce the velocity of flow or amount of temporary storage will affect runoff rates. The temporary storage of water in terrace channels plays an important part in the reduction of peak flows.

From analyses of the data for the period of record, conservation practices would have reduced the peak rate of runoff from area Y-2 for the storm of June 10, 1941, from 3.05

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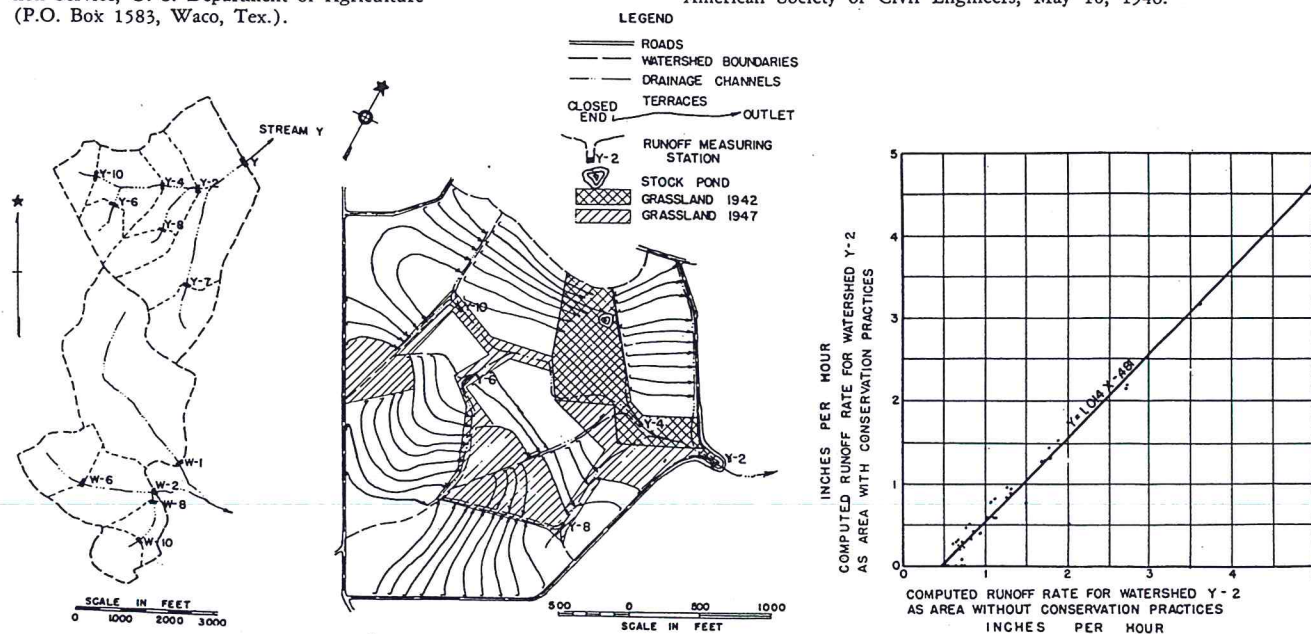


Fig. 1 (Left) Areas Y and W, showing location of runoff measuring stations • Fig. 2 (Center) The Y area, showing variable-grade terraces • Fig. 3 (Right) Effect of land changes on peak rates of runoff for the Y-2 area

TABLE 1. LAND USE

Crop	Area W-1 176 acres		Area W-10 19.7 acres		Area Y-2 132 acres		Area Y-6 20.9 acres		Area Y-10 21.0 acres	
	1942 Per cent	1947 Per cent	1942 Per cent	1947 Per cent	1942 Per cent	1947 Per cent	1942 Per cent	1947 Per cent	1942 Per cent	1947 Per cent
Cotton	47.6	34.6	49.3	52.0	46.1	22.9	50.2	32.1	50.0	28.8
Corn	22.8	18.1	25.9	35.7	22.7	25.6	24.9	19.3	25.8	29.7
Oats or oats with Hubam clover	14.3	20.7	24.8	12.3	18.6	22.6	24.9	33.5	24.2	27.8
Pasture or meadow	10.6	16.5	0	0	8.9	27.5	0	15.1	0	13.7
Sorghum and other crops	4.7	10.1	0	0	3.7	1.4	0	0	0	0

to about 2.50 iph (inches per hour), and for the storm of May 1, 1944, the actual peak rate of runoff with conservation practices was 4.07 iph but would have been about 4.50 iph with ordinary farm practices. From a comparable area with ordinary farm practices the measured peak rate of runoff on May 1, 1944, was 4.51 iph. The storm of June 10, 1941, had rainfall rates of 4.38 iph for a 25-min period, and that of May 1, 1944, 4.52 iph for a 25-min period.

Using a similar method of analysis, almost the same results were obtained for the 20-acre area, Y-10, with a shorter period of record which did not include such high rates. It is probable that, particularly for the smaller areas, the terrace length is a factor that must be considered.

The effect of conservation practices on the total amount of runoff is not as clearly defined and more data are needed before definite statements on the effect can be made. When the soil is relatively dry at the start of the storm period, there seems to be slightly less runoff from the areas with conservation practices. During long periods of wet weather when all soil moisture deficiencies are satisfied, there seems to be little or no difference between the treated and untreated areas. Considering the amount of area returned to permanent grass cover and measured runoff from grass lands both at Waco and elsewhere, a considerable reduction in the amount of runoff should be expected, except when the soil is very wet. This result has not been apparent, possibly because some time is required before grasses have a great effect and possibly be-

cause of the location of much of this grassed area along stream channels. It is hoped that some information on an area returned to pasture can be obtained for comparison with native meadow areas.

Some information is also available on the amount of suspended material carried through the runoff measuring stations. Water samples have been manually collected in bottles from the water passing through the measuring flume at regular intervals during the major floods. While this method of sampling will not give the true total amounts, the relative amount from similar areas sampled in the same manner should be nearly correct. Records are available from two 20-acre areas, Y-6 and W-10, during 1941 when both areas were treated alike, and December, 1942, through June 1943 after the area Y-6 had conservation practices established. For 1941, Y-6 had measured soil loss of suspended material of 284 tons, while W-10 had 239 tons, or a ratio of 1.19 to 1. For the period December 1942 through June 1943 the amounts were 9.9 tons and 109 tons, respectively, a ratio of 0.09 to 1, or less than one-twelfth of that prior to treatment. Results may not be so extreme for the larger storms. Additional results on this subject are being obtained.

These results from the Waco Experimental Watershed are beginning to answer some of the questions regarding the effects of conservation practices on runoff for this area. When more of the stations now inoperative can be reestablished much more information will be available.

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