ANNUAL REPORT

1941 - 1942

SOIL AND WATER CONSERVATION RESEARCH

(Bankhead-Jones Fund Project)

Agricultural Engineering Department
Virginia Agricultural Experiment Station
Blacksburg, Virginia

in cooperation with

Research Division, Soil Conservation Service
and
Agricultural Division, Tennessee Valley Authority

July 1, 1942

SOIL AND WATER CONSERVATION RESEARCH

1941 - 1942

1. Personnel:

C. E. Seitz, Head of Dept. (part-time)	Va. Agri. Expt. Sta.
J. H. Lillard, Jr., Asst. Agr. Engr. (July 1, 1941-May 17, 1942)	
Howard T. Rogers, Asst. Soil Tech. (July 1, 1941-Sept. 1, 1941) (June 8, 1942-July 1, 1942)	
Woodrow N. Linkous, Acting Asst. Soil Tech. (Sept. 1-6, 1941)	
Emanuel Azar, Acting Asst. Soil Tech. (Oct. 1, 1941-May 31, 1942)	
D. W. Cardwell, Assoc. Hydr. Engineer (part-time)	S. C. S.
Jesse Elson, Jr. Soil Surveyor	
W. H. Dickerson, Asst. Agri. Engr. (part-time)	T. V. A.

Woodrow N. Linkous was appointed Acting Assistant Soil Technologist on September 1, 1941 to fill the position vacated by H. T. Rogers who was on leave to pursue graduate work from September 1, 1941 to June 8, 1942. Mr. Linkous resigned September 6 to accept a position with the New River Ordnance Works. On October 1, 1941, Emanuel Azar was appointed as Acting Assistant Soil Technologist and served in this capacity until May 31, 1942. J. H. Lillard was granted leave for a civilian position with the U. S. Army in war service beginning May 17, 1942. His duties were taken over by Emanuel Azar.

2. Progress and results of research:

(A) Soil and water losses from cropland: Operation of the system of runoff plots to study the effects of slope, character of soil, rainfall, and cropping treatments on erosion losses was continued.

Due to unusually low annual rainfall and the almost complete absence of the usual high-intensity summer thunderstorms, there were no important runoffs from the control plots during the year. Considerable time was spent in tabulating and computing rainfall intensity data, as well as runoff records of the past few years. Analysis of past records from the runoff plots have provided additional information on the effect of cover and slope on rates and amounts of runoff in the Limestone Region of Virginia.

A report of a laboratory study of the nature of eroded materials and plant nutrient losses from these plots during the period 1937-1940 was made. The aims of this study were: (1) to obtain quantitative information on the total amounts of the major nutrient elements removed by erosion from Dunmore silt loam (an extensive cropland soil type in the limestone valleys of southwestern Virginia), when cropped to a corn, wheat, clover rotation, and (2) to evaluate the seriousness of these losses by a study of the

relative solubility of the nutrient elements in the eroded material. The material which was eroded from 5 to 25% slopes of this soil when cropped to corn was 16 and 11% richer in total nitrogen and phosphorus, respectively, than the original soil. However, the average loss of the soil's supply of total N, P_2O_5, CaO, K_2O, and MgO in the A_p horizon by erosion during the 3-year rotation was only about 1.5%. The surface soil of the plots cropped to corn contained 38 p.p.m. of dilute sulfuric acid-soluble phosphorus, while the material removed from these plots by erosion contained 70 p.p.m. of this "available" phosphorus. Likewise, the eroded material showed a higher concentration of exchangeable potassium (1.42 M.E./100 gms.) than the original soil (0.59 M.E./100 gms.). Also, the eroded material contained 6 to 8 times as much water-soluble organic phosphorus as did the parent soil. These results show the more easily extractable nutrient forms of these elements were being lost from the soil by moderate amounts of erosion at greater rates than the less soluble forms. It was concluded that relatively slight sheet erosion may result in a temporary lowering of the fertility level of a soil out of proportion to the amount of soil lost.

A study of the effect of cropping and fertilizing treatments on the physical properties of the soil as they affect its erodibility led to an investigation of the relationship of different fractions of soil organic matter to soil aggregation. Soil samples from 96 plots of a 32-year fertility study (conducted by the Agronomy Department) were used in this investigation.

During the year, 576 samples were analyzed for total and alkali soluble organic matter for a total of 1152 determinations. This analytical work was conducted in an attempt to explain a relationship which existed between organic matter and soil aggregation in 1940 after liming, and did not exist in 1941 without further liming. The alkali soluble organic matter in these soil samples was determined in order to ascertain whether this is the specific constituent of the organic matter involved in soil aggregation.

The data obtained for both the 1940 and 1941 seasons showed that the large soil aggregates (1-2 mm.) contained more of the alkali-soluble organic matter than the small aggregates (0.1-0.25 mm.). This indicated that the alkali-soluble organic matter had collected in the large soil units and may have acted as a cementing agent in the soil. These data also supported the contention of some investigators that lime in the soil hastens the decomposition of organic matter.

Some progress was made in the preparation of material for a bulletin on erosion control in Virginia.

(B) Moisture conservation and erosion control on permanent pastures; During the year, the old contour furrow study (2.A (1) in the Revised Project Outline) of the most effective spacing of furrows for moisture conservation and control of erosion in permanent pastures was discontinued, as

it had provided preliminary information needed for designing a more complete experiment on furrows. A working plan was drawn up for this new investigation entitled "The Practicability of Contour Furrows for Control of Erosion in Permanent Pastures of Virginia." (This is project 2.A (2) in the Revised Project Outline).

The specific objectives of this study are: (1) to determine the erosion control afforded by contour furrows on permanent pasture land, (2) the effect of contour furrows on moisture conservation and distribution, and (3) the effect of distribution of water by contour furrows on the growth of pasture vegetation.

To attain these objectives, twelve one-fiftieth acre plots, with four treatments triplicated, were laid out on Dunmore soil on permanent pasture land on the "Smithfield" farm. Figure 1 is a sketch of the randomized block layout for these 12 plots showing the treatments and plot assignments.

The twelve plots were enclosed by oak boards inserted approximately six inches in the ground. At the lower end of each plot a concrete catchment trough (see photograph) and approach flume were constructed. Figure 2 is a detail drawing of this installation.

The effects of the treatments will be determined by soil and water losses, vegetative yields, and soil moisture data.

Further details of this experiment may be seen from the attached photographs.

The results of the study of the effect of superphosphate on runoff and erosion from pasture land were reported in Bulletin 77. All the plots used in this study were discontinued, except a group at the Glade Spring Substation where new side wall installations were made. Records of runoff from these plots and from seven pasture watersheds are being kept.

(C) Rates and amounts of runoff from small agricultural watersheds: Records of rainfall and runoff, as well as soil moisture and cover conditions, have been collected throughout the year on watersheds W-II and W-III. Watershed W-I was discontinued because a runway of the enlarged VPI Airport has dissected the area and its effect on runoff cannot be evaluated without a resurvey of this watershed.

A survey of the new gaging station, which was constructed on W-III in 1940, was made and a final design drawing prepared. Rating tables for this station are now available to date.

Considerable effort has been made to bring the records from the two Blacksburg watersheds to date. All runoff data from W-II and W-III have been compiled for the years 1939, 1940 and 1941. Data from the rainfall measuring station serving these two watersheds have been completely compiled for the year 1940 and part of the year 1939. Summary tabulations of outstanding runoffs from the two Blacksburg watersheds have been started.

In addition, records of rainfall and runoff have been collected from Danville watersheds W-I, W-II and W-III, and progress has been made in compiling and computing past records from these watersheds. A hydrologic bulletin covering runoff studies at Danville and Blacksburg is being prepared.

The year 1941 was unusually dry at Blacksburg where the total precipitation amounted to 27.6 inches as compared to a normal of 43.0 inches. This dryness continued until about the middle of May, 1942, when the drought was broken. Since then many heavy rains and thunderstorms have occurred, producing several high runoffs and considerable erosion on the two Blacksburg watersheds.

3. Publications:

A. Publications issued:

1. Addy, C. E., DeLaBarre, C. F., and Cardwell, D. W. Suggestions for the Building and Management of Farm Fish Ponds in Virginia. Bul. of the Va. Poly. Inst. Vol. XXXV, No. 11. June, 1942.

2. Cardwell, D. W. and Dickerson, W. H., Jr. Runoff from Terraced Areas under Conditions of Extreme Flood. Transactions of the American Geophysical Union, Part III, 856-862. 1941.

3. Dickerson, W. H. Jr., and Rogers, H. T. Surface Runoff and Erosion from Permanent Pastures in Southwest Virginia as Influenced by Applications of Triple Superphosphate. Virginia Agricultural Experiment Station Technical Bulletin 77, December, 1941.

4. Elson, Jesse. A Comparison of the Effect of Certain Crops, Fertilizer and Manure, Carbon-Nitrogen Ratio, and Organic Matter on Water-stable Aggregates. Proceedings of the Soil Science Society of America. 6:86-90. 1941.

5. Lillard, James H. Effect of Crops and Slopes on Rates of Runoff and Total Soil Loss. Agricultural Engineering Journal, Volume 22: 396-398, November, 1941.

6. _____, Rogers, H. T., and Elson, Jesse. Effects of Slope, Character of Soil, Rainfall, and Cropping Treatments on Erosion Losses from Dunmore Silt Loam. Virginia Agricultural Experiment Station Technical Bulletin 72, August, 1941.

7. Rogers, H. T. Plant Nutrient Losses by Erosion from a Corn, Wheat, Clover Rotation on Dunmore Silt Loam. Proceedings of the Soil Science Society of America. 6:263-271. 1942.

B. Manuscripts Prepared:

1. Cardwell, David W. Forms of Presentation of Hydrologic Information. Paper presented at the Winter Meeting of the American Society of Agricultural Engineers, December, 1941.

2. Elson, Jesse and Azar, Emanuel. Total and Alkali-soluble Organic Matter in the Soil and Aggregates as Influenced by Liming.

3. Lillard, James H. Engineering Aspects of Vegetation in the Conservation of Soil and Water. Presented before the Soil and Water Conservation Section of the North Atlantic Meeting, American Society of Agricultural Engineers, at Jackson's Mill, West Virginia, September, 1941.

4. Accomplishments:

Most of the results of these studies have been summarized and reported in station bulletins or technical journals. The results are being used by farmers, extension men, and other agricultural workers in the state. Specific runoff data have been furnished the Hydrologic Division, T.V.A., The Potomac Flood Control Survey, and the S.C.S. Regional Engineering Division to be used as a basis for the design of erosion control measures. The Blacksburg and Danville data have been used as a basis for the design data appearing in a recent bulletin on farm fish ponds.

5. Work to be completed during 1942-1943:

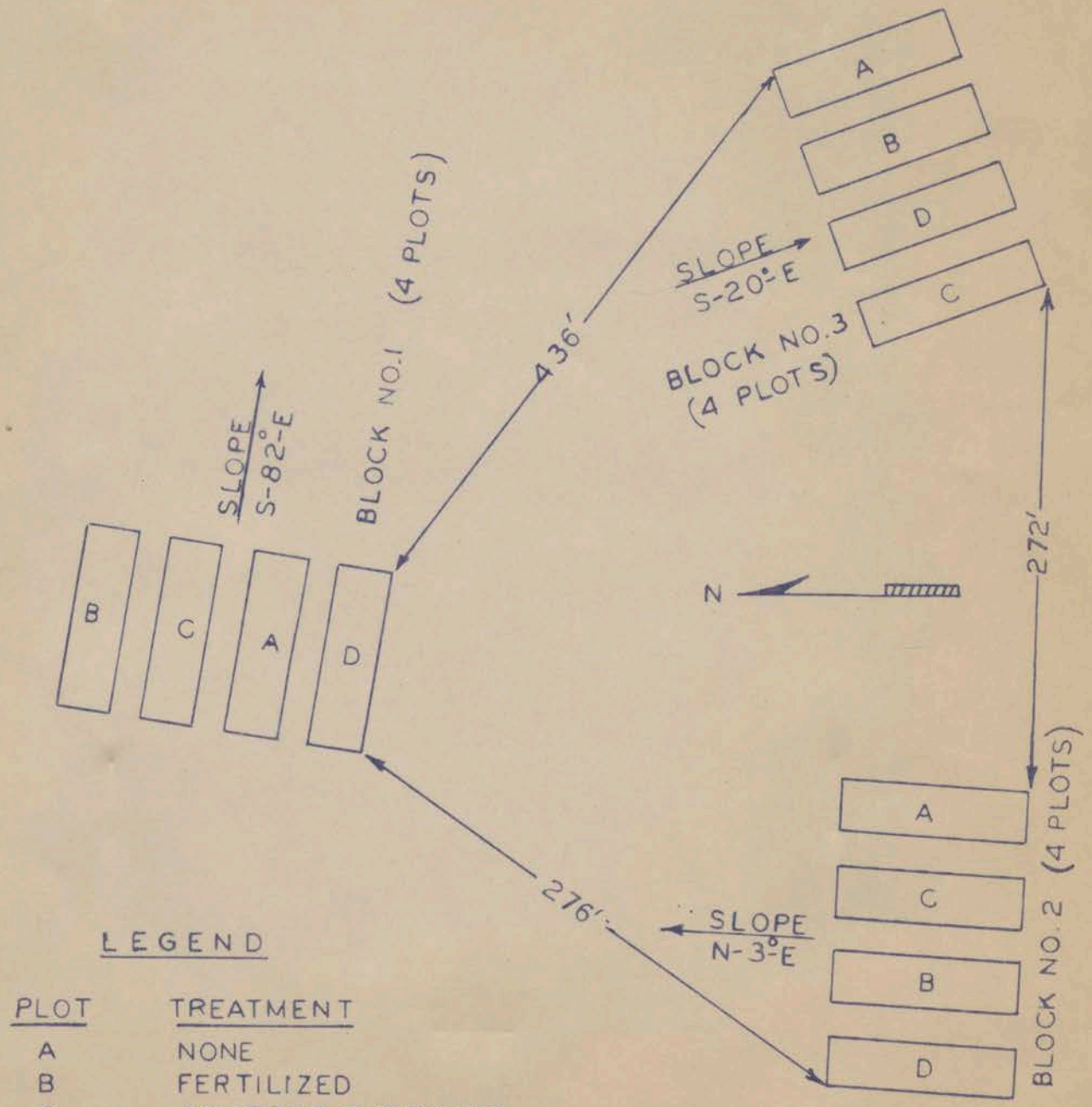
It is believed reports can be made on the following investigations:

1. The loss of surface applied superphosphate and limestone through runoff from pasture sods. Probably for journal publication.

2. Hydrologic data-Runoff Studies near Blacksburg and Danville, Virginia. Most suitable for technical bulletin.

FIGURE: 1

LAYOUT OF PLOT SYSTEM FOR CONTOUR FURROWS STUDY AT BLACKSBURG, VA.



LEGEND

PLOT	TREATMENT
A	NONE
B	FERTILIZED
C	CONTOUR FURROWED
D	CONTOUR FURROWED AND FERTILIZED.

SCALE 1" = 50'-0"

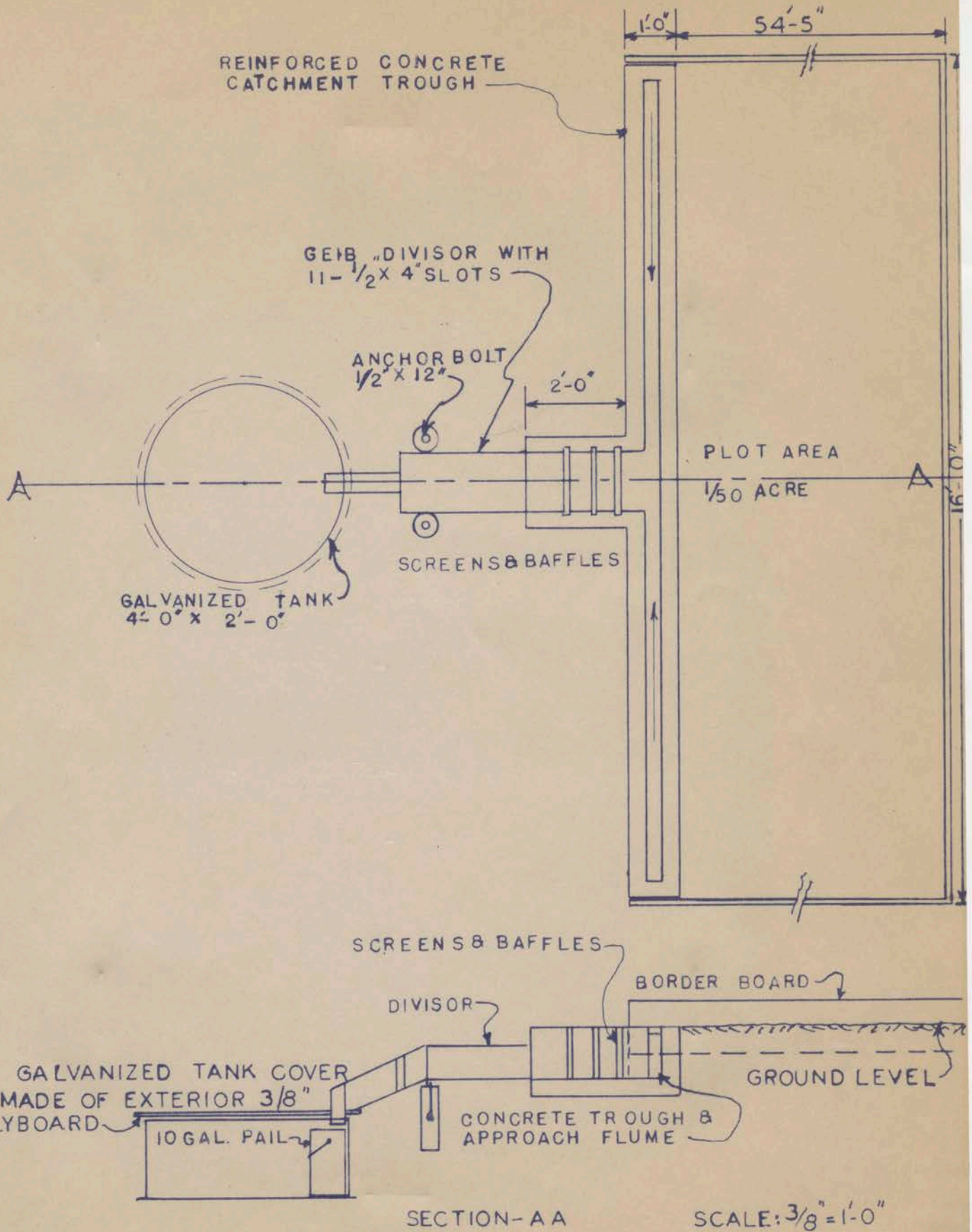
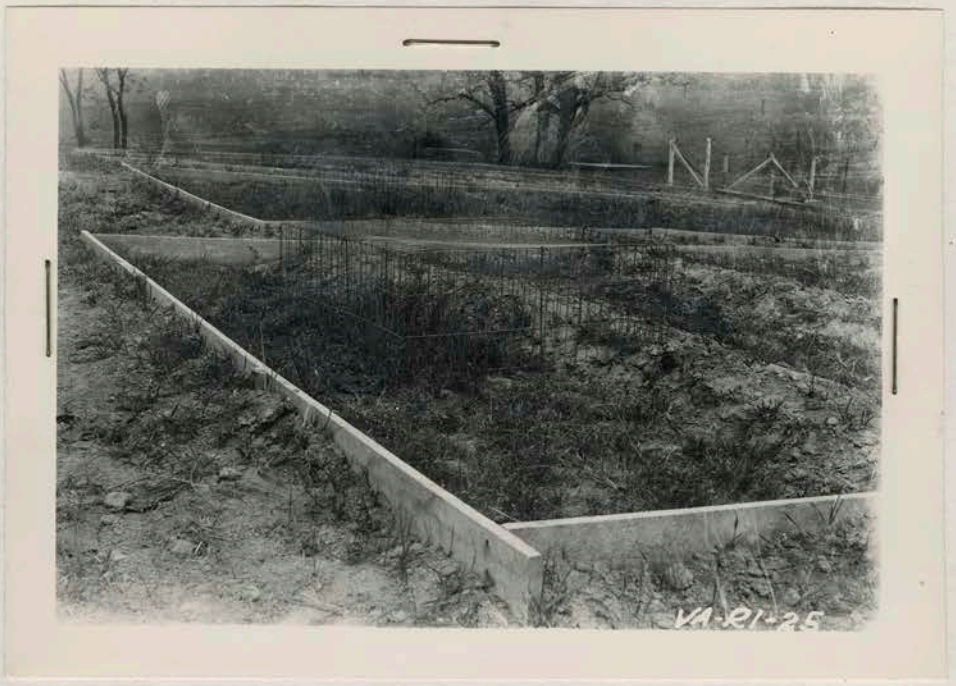


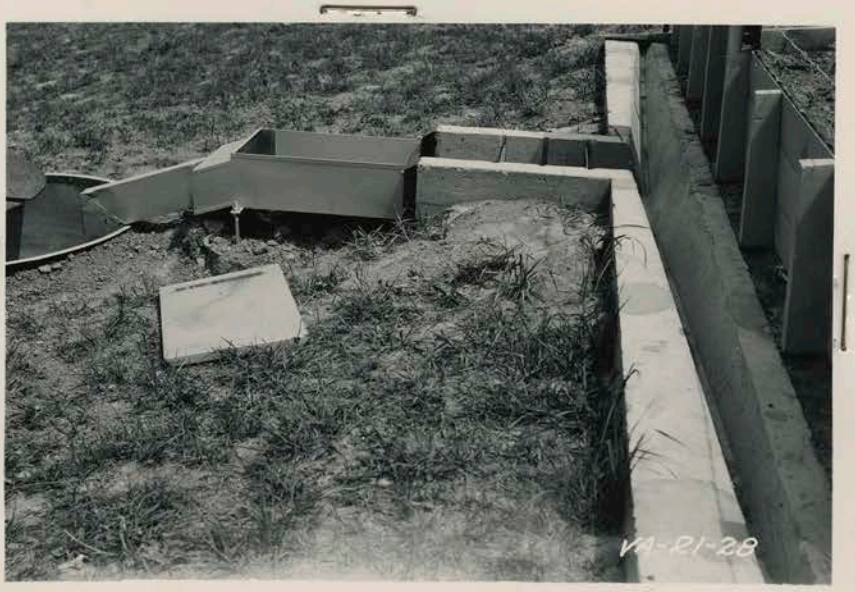
FIGURE-2

DETAIL OF INSTALLATION ON CONTOUR FURROW PLOTS AT BLACKSBUR, VIRGINIA.

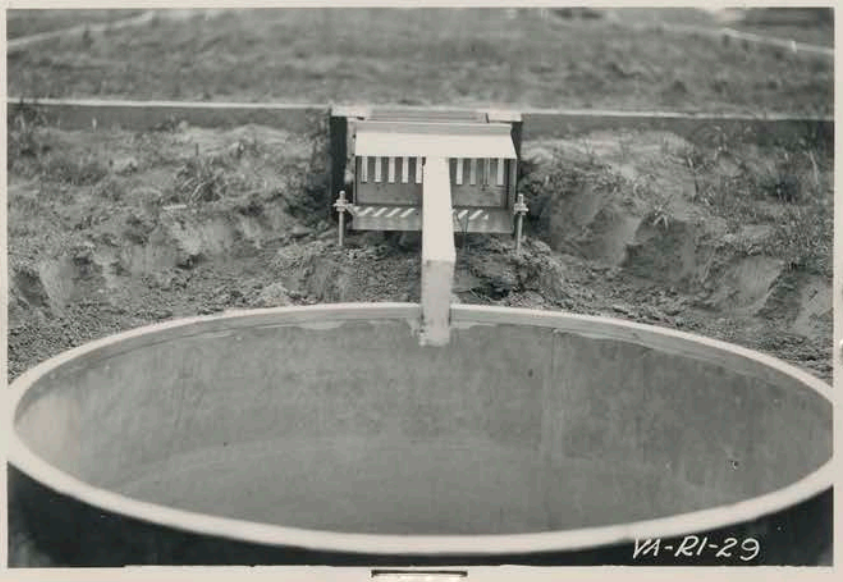


A general view of the four plots in Block No. 1 of the study of contour furrows on pasture land.

View of newly constructed contour furrows on plot "C" of Block No. 1. Plot "B" is in the background.



A detail view of concrete catchment trough, approach flume, divisor, and galvanized tank on plots of the new pasture furrow study.



A view showing the Geib divisor and galvanized tank for fractionating and catching runoff from the plots.