October 1972 WRRI Report No. 011

13030 GLM

Quarterly Progress Report

QUALITY AND QUANTITY OF RETURN FLOW AS INFLUENCED BY TRICKLE AND SURFACE IRRIGATION

July, August and September - 1972

PROGRESS REPORT ON PROJECT

WRRI-308

July, August, September

1972

Progress during the last three months has been according to the Schedule as outlined in the Task Description and Time Table for the second year of study included in the first annual report, and included herein as figure 1. Accomplishments this quarter are discussed in the sequence they appear.

1. Grow and Harvest Cotton Crop (figure 1)

Irrigation of the cotton being grown on the nine surface treatments was completed by September 1, 1972. It is common practice to complete irrigation by the end of August. This causes a slow down of the vegetative growth and earlier maturation.

All plots received approximately eight-inch preirrigation. The first irrigation after planting, applied in late June, totaled four inches on all plots.

From July 1 to the end of the irrigation season, all plots were irrigated according to treatment. Depletions were computed according to correlation with pan evaporation, as outlined in the first annual report. The pan and rain gage installation are shown in figure 2.

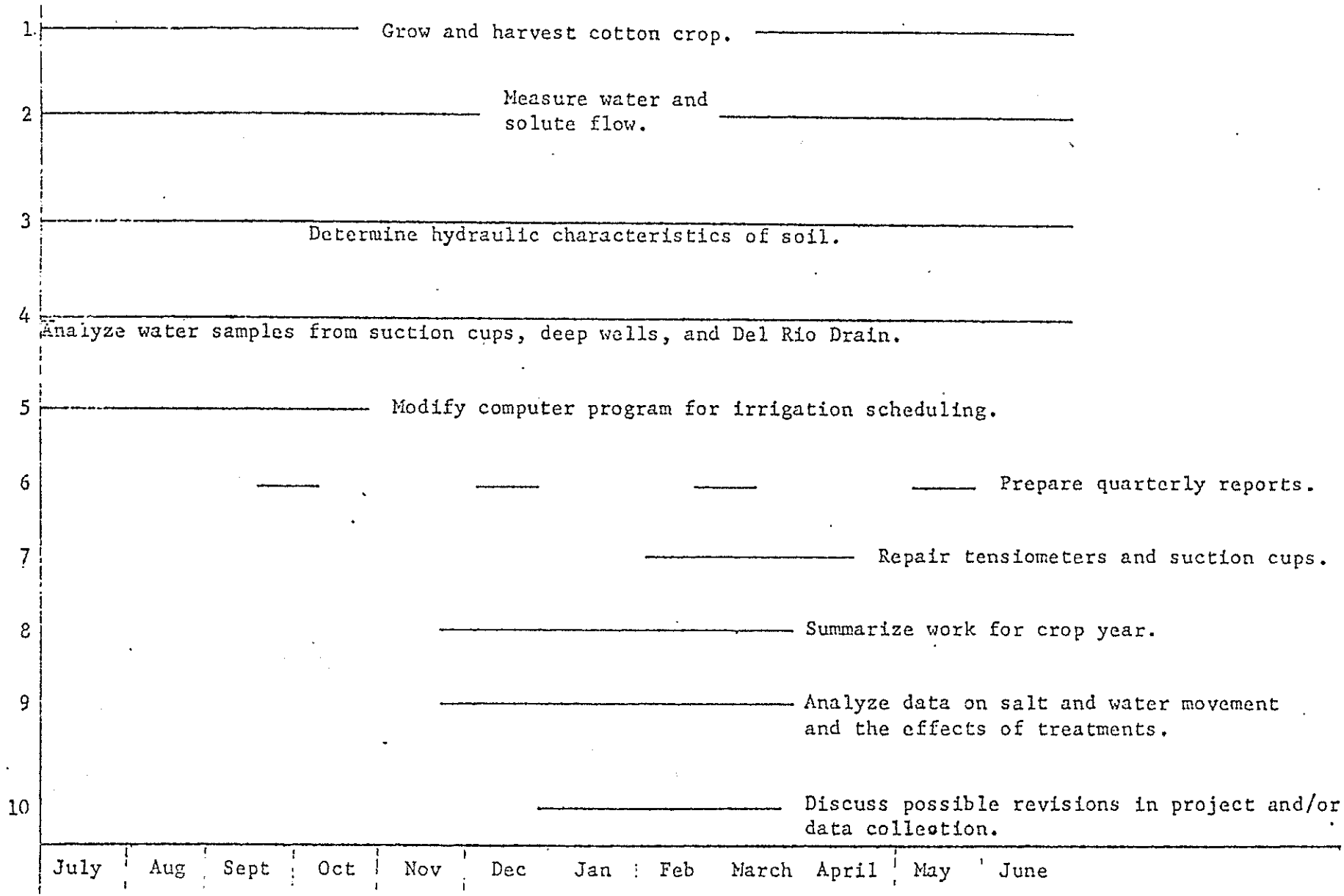

Fig. 1. Task description and time table for second year of study

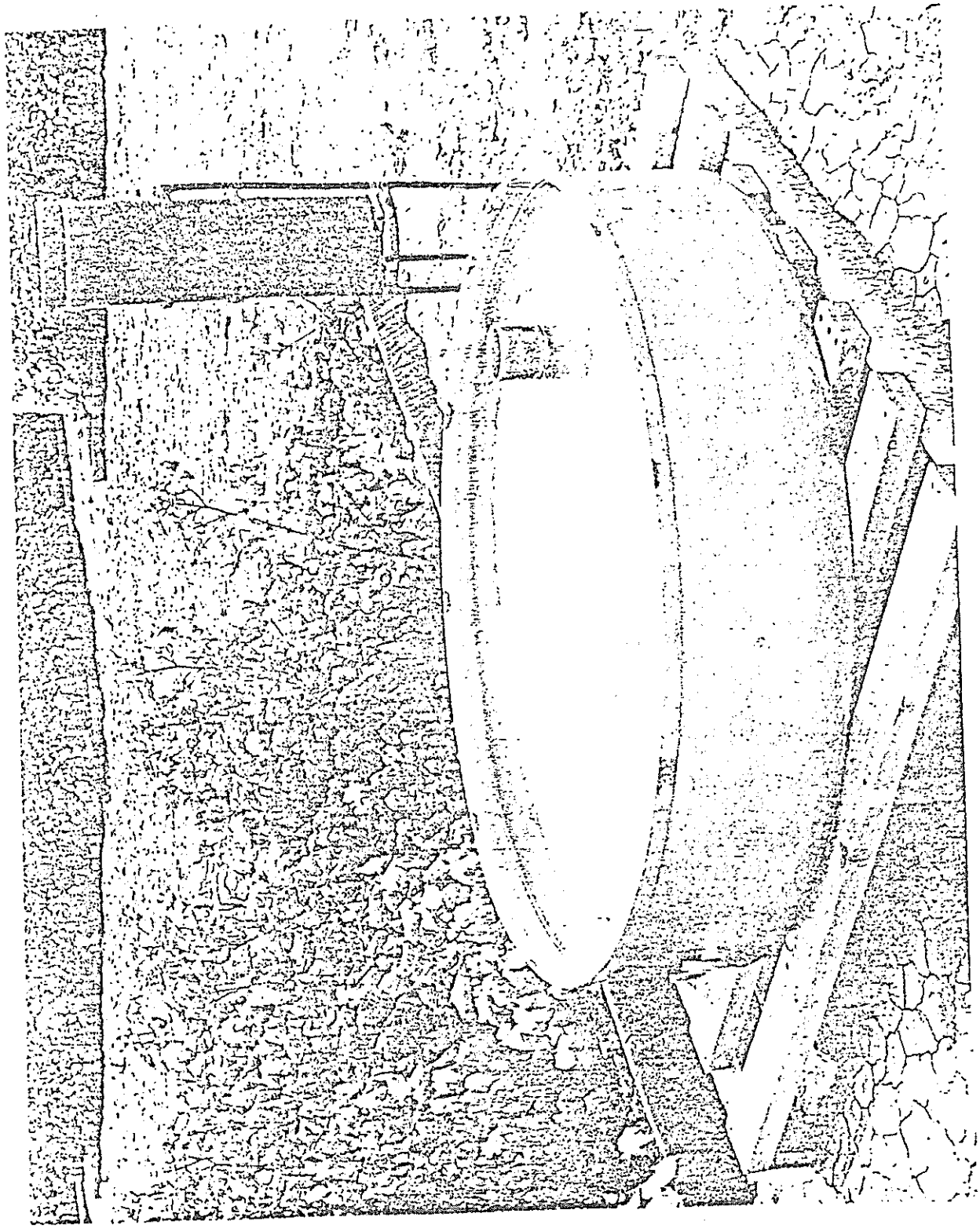

Figure 2. Evaporation pan and rain gage in plot area

The amounts of irrigation water applied, the achieved efficiencies, etc. are shown in table 1.

Table 1. Summary of surface irrigation treatments

Trmt.	Wtr.App. prior to 7/1 (in)	Total App. (in)	Net (in)	ET (in)	Rain (in)	Net Irr. Req. (in)	No. of Irr. (No.)	Irr. Eff. (%)	Planned Eff. (%)	Depl. Avail. Wtr. Allowed prior to each Irr. (%)
1	12.08	36.41	24.33	18.23	4.54	13.69	7	56	50	25
2	12.18	36.75	24.57	18.23	4.54	13.69	5	55	50	50
3	12.07	34.94	22.87	18.23	4.54	13.69	3	59	50	75
4	12.04	28.23	16.19	18.23	4.54	13.69	7	84	75	25
5	12.08	29.39	17.31	18.23	4.54	13.69	5	79	75	50
6	12.11	27.19	15.08	18.23	4.54	13.69	3	89	75	75
7	11.97	24.90	12.93	18.23	4.54	13.69	7	106*	100	25
8	12.08	24.67	12.59	18.23	4.54	13.69	5	110*	100	50
9	12.20	23.58	11.38	18.23	4.54	13.69	3	119*	100	75

* Application efficiencies > 100% not possible--simply indicate computed use not fully replaced.

General appearance of the cotton in the surface plots in late September is shown in figure 3.

The treatments are as outlined in previous reports.

The total ET for July and August, as computed from E_p, is 18.23 inches which results in a daily ET of .294 inches per day.

Figure 3. General appearance of surface plots--September, 1972

The cotton being grown under the two trickle-irrigation treatments, as outlined in a previous report, was irrigated according to treatment from just after planting to late September.

Amounts of water applied, etc. are shown in table 2. The general appearance of the cotton in the trickle plots in late September is shown in figure 4.

Table 2. Summary of trickle irrigation treatments

Trmt.	Preplant Irr. (in)	Total App. (in)	Gr. Season (in)	No. of Irr. (No.)
TT-1	8.00	27.82	19.82	26
TT-2	8.00	16.23	8.23	12

It is anticipated that the first picking of all treatments will be completed in October and a second picking completed in November.

2. Measure Water and Solute Flow

The tensiometers installed in each plot, as indicated in the first annual report, have been monitored on a daily basis. From the tensiometer reading, hydraulic gradients were calculated for each day for each plot.

The soil moisture content in each plot was monitored with neutron equipment periodically through the summer.

Figure 4. General appearance of trickle plots--September, 1972

3. Determine Hydraulic Characteristics of the Soil

In order to calculate the amount of water leaching from each plot from the hydraulic gradients below the root zone, the hydraulic conductivity of the soil below the root zone has to be known accurately as a function of water content.

During this quarter, the three 24 × 24 feet plots set aside for this purpose have been fully instrumented.

Twenty-four tensiometers have been installed in each of the three plots ranging from 30 cm to 180 cm in depth. Two neutron access tubes are also established in each special plot. Analyses of the hydraulic characteristics of the first of the three plots has commenced. The plot was ponded with water (16 inches total applied) until no changes in soil water pressure with depth within the profile were noted. The plot was covered with plastic, incorporating a "trap door" over the instrument battery to allow easy access. After covering the plot with plastic, the tensiometers and the neutron access tubes are read twice a day to monitor changes in water content and tension with time and depth.

Changes in soil water pressure are measured at each of eight depths with three tensiometers. From this data, the hydraulic conductivity of the various strata can be calculated.

Similar studies on the two remaining special plots will commence during the next quarter.

The instrumentation within the special plot, prior to covering with plastic, is shown in figure 5.

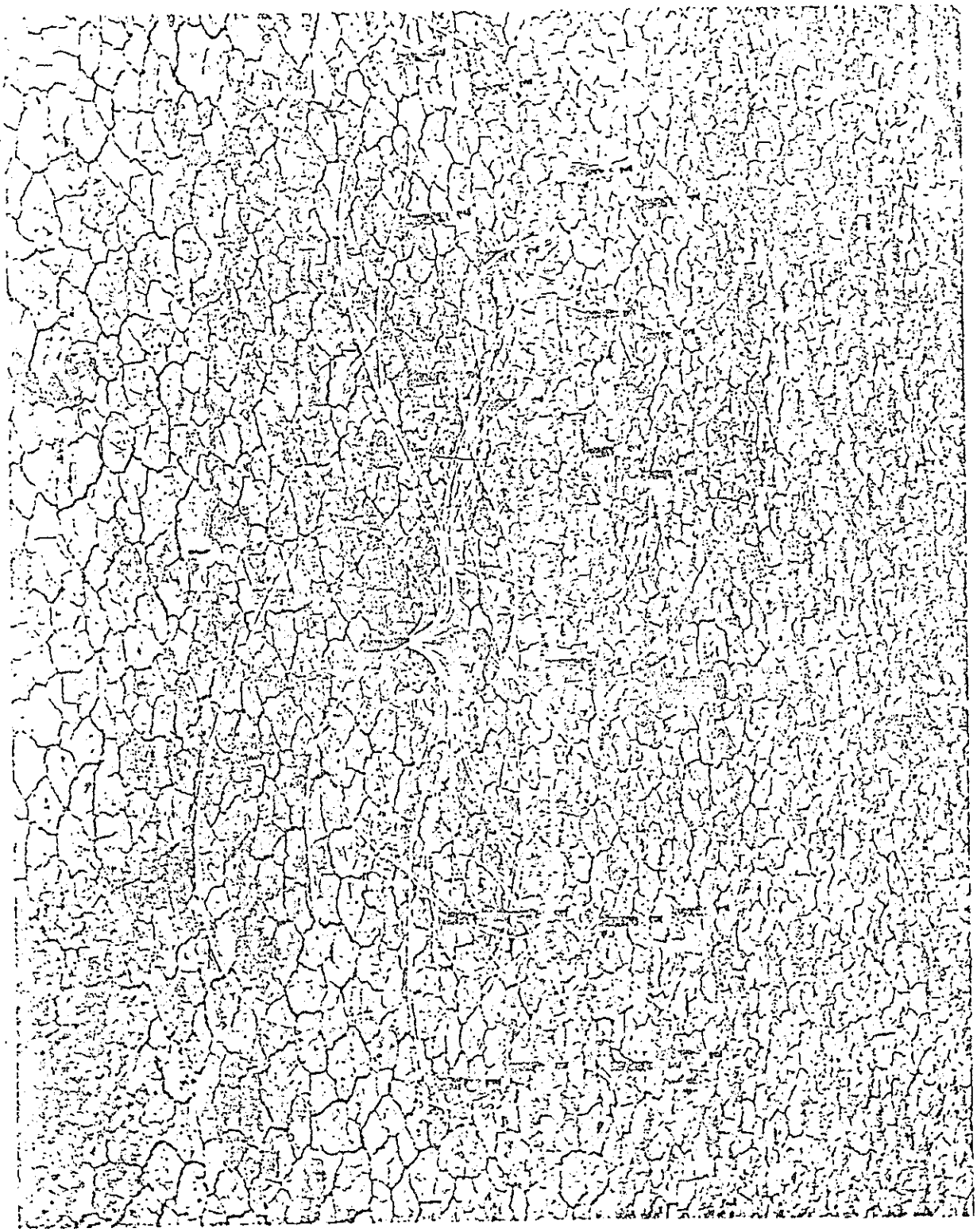

Figure 5. Special plot instrumentation

4. Analyze Water Samples from Suction Cups--Deep Wells and Del Rio Drain

Soil solution samples from the various plots were extracted periodically beginning on June 27, 1972. Table 3 shows the electrical conductivities of samples collected at various times during the irrigation season. Conductivity data prior to August 23, 1972 were somewhat erratic. This is attributed to evaporation of the sample in the collection bottle. Beginning August 23, a high-grade mineral oil was placed in the collection bottle to prevent evaporation from the free-water surface in the bottle.

It should be noted that no samples have been collected from plots 9, 13, 24, and 27. Plots 9, 13, and 27 are replicates of treatments 7, 9, and 8, respectively, all of which are 100 percent efficiency plots. Therefore, little if any water has been transmitted to the zone of sampling. Plot 24 is a replicate of treatment 4 which is irrigated with a 75 percent efficiency. Apparently the soil at the suction cup was too dry to allow extraction of a sample.

Samples from only two trickle plots have been extracted and, surprisingly, both from the lower moisture level plots.

Sampling of the deep wells and the Del Rio Drain water were continued, as well as the continuous monitoring of the quantity of flow in the Del Rio Drain. Results up to July 1, 1972 were included in the First Annual Report and will not be brought up-to-date here. Current data will appear in a later quarterly or annual report.

5. Modify Irrigation Scheduling Program

This item of work has not been completed but should be finalized in the next three months.

Table 3. Electrical conductivity (mmhos/cm) of soil solution samples by date - 1972

Plot No.	June 27-28	July 5-9	July 25 thru Aug. 1	Aug. 23-29
1	-	.76	-	-
2	-	-	11.76	8.82
3	-	-	-	.34
5	-	4.03	14.27	7.40
6	-	2.29	6.42	6.56
7	3.14	3.17	8.12	4.00
8	-	6.26	-	-
9	-	-	-	-
10	9.30	9.49	14.53	11.40
11	-	-	10.09	9.24
12	-	-	-	9.12
13	-	-	-	-
14	-	5.60	6.85	6.30
15	-	-	-	9.04
16	-	-	-	6.16
17	-	4.24	11.11	5.90
18	-	8.36	-	8.66
20	-	9.82	15.49	9.70
21	-	-	3.01	2.88
22	2.03	2.02	1.97	1.90
23	-	2.40	10.58	2.68
24	-	-	-	-
25	4.34	4.83	5.67	6.42
26	6.84	10.87	8.61	7.56
27	-	-	-	-
29	-	8.13	10.20	9.44
30	-	-	11.67	9.54
T-1	-	3.59	3.67	3.88
T-2	-	-	-	-
T-3	-	-	-	-
T-4	-	-	-	-
T-5	-	-	-	-
T-6	-	5.88	6.32	5.76

Items 6 through 10, as shown in figure 1, are not reported in this quarter.

A large number of persons have visited the project during the quarter. A brief summary of work underway and a tour of the area was presented to all interested Agronomy faculty at New Mexico State University, approximately 50 members of the Rio Grande Chapter of the Soil Conservation Society of America, the New Mexico Cotton Advisory Council, and numerous smaller groups. One such group is shown in the background of figure 3.