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13030 GLM

Quarterly Progress Report

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

January, February, and March - 1973

PROJECT 13030 GLM

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

Quarterly Report for the Period

January 1, 1973 to March 31, 1973

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PROGRESS REPORT

WRRI-308, PROJECT 13030 GLM

January, February, March

1973

Accomplishments this past quarter are discussed in the sequence they appear in the Task Description and Time Table for the second project year included herein as Figure 1.

1. Grow and Harvest Cotton Crop

Cotton samples from each plot were analyzed for quality in the Cotton Fiber Laboratory at New Mexico State University. The results of the analyses are presented in Tables 1, 2 and 3.

Table 1. Effects of irrigation efficiency on quality of cotton (treatment means) in surface plots.

Irrigation Efficiency %	Lint %	2.5% Span	Uniformity Ratio	MIC	Strength	Elongation
			1c Pick			
50	36.1*	1.21	47.3*	4.0*	24.8*	6.8
75	35.3*	1.23	46.2*	4.0*	25.7*	6.6
100	35.3*	1.22	44.6*	3.5*	26.0*	6.6
			2c Pick			
50	37.8	1.17	43.6	3.8	20.2	6.7
75	36.8	1.19	42.6	3.6	20.5	7.1
100	36.9	1.17	42.6	3.7	20.4	6.5
			1c and 2c Pick Combined			
50	37.0*	1.19	45.5*	3.9	22.5*	6.7
75	36.1*	1.21	44.4*	3.8	23.1*	6.8
100	36.1*	1.19	43.6*	3.6	23.2*	6.6

* Significant differences at the 5% level.

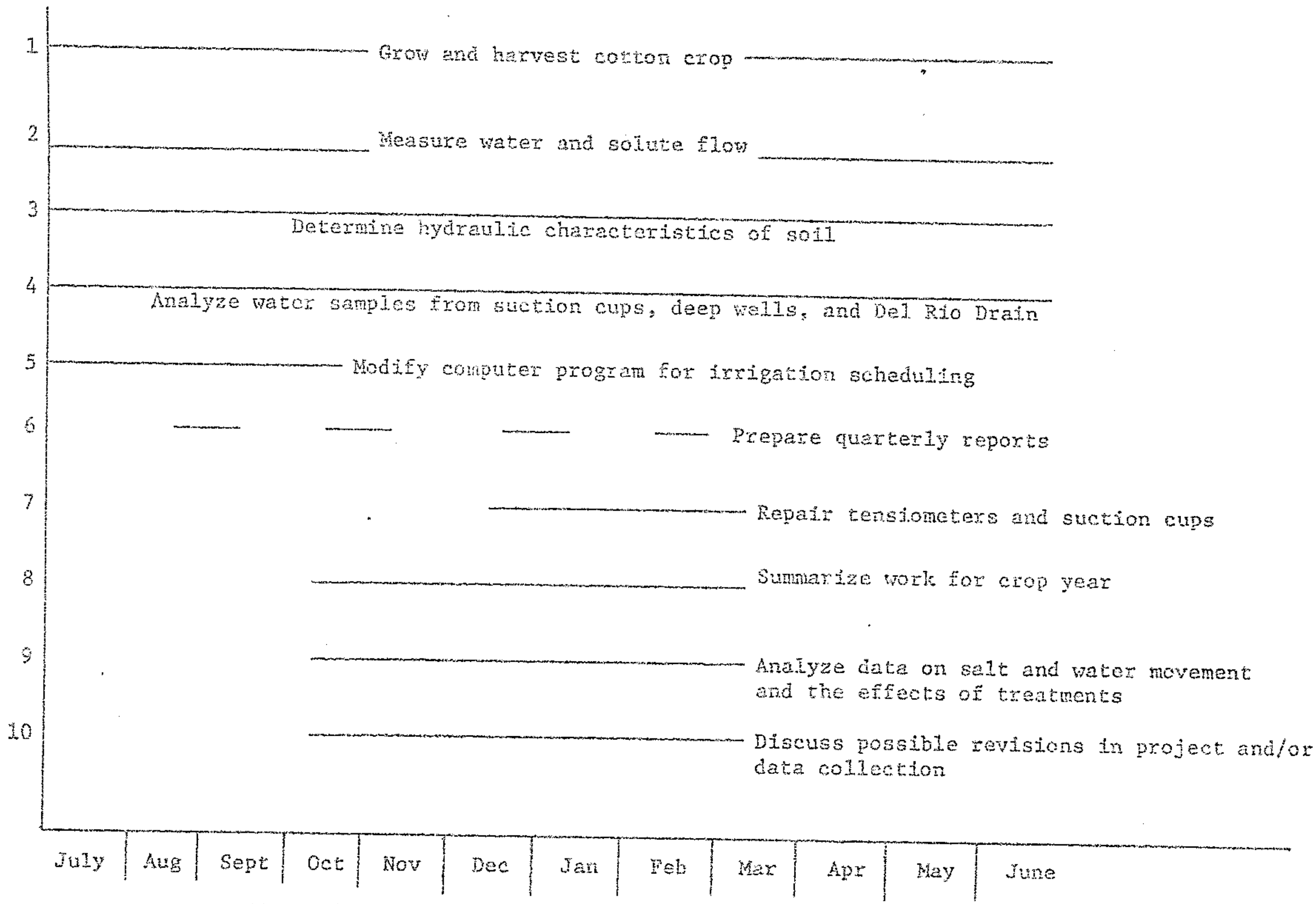

Figure 1. Task description and time table for second year of study

Table 2. Effects of water depletion on quality of cotton (treatment means) in surface plots.

Depletion %	Lint %	2.5% Span	Uniformity Ratio	MIC	Strength	Elongation
			1^c Pick			
25	35.5*	1.23	46.3	3.7	25.6	6.7
50	36.2*	1.21	46.3	4.0	25.1	6.5
75	35.0*	1.22	45.5	3.8	25.9	6.7
			2^c Pick			
25	37.0	1.18	43.6	3.7	20.2	6.7
50	37.7	1.17	43.3	3.8	20.6	6.7
75	36.9	1.17	42.0	3.6	20.3	6.9
			1^c and 2^c Pick Combined			
25	36.2*	1.21	44.9	3.7	22.9	6.7
50	37.0*	1.19	44.8	3.9	22.8	6.6
75	36.0*	1.19	43.7	3.7	23.1	6.8

* Significant differences at the 5% level

Table 3. Effects of soil water tension at 30 cm on cotton quality in trickle plots.

Tension Bars	Lint %	2.5% Span	Uniformity Ratio	MIC	Strength	Elongation
			1^c Pick			
0.2	36.9	1.16*	45.2	4.1	25.4	5.9
0.6	34.7	1.26*	46.1	3.6	25.9	6.7
			2^c Pick			
0.2	38.3	1.14	42.9	4.1	22.4	8.0
0.6	37.6	1.18	43.4	3.4	20.3	7.5
			1^c and 2^c Pick Combined			
0.2	37.6*	1.15*	44.1	4.1*	23.9	7.0
0.6	36.1*	1.22*	44.7	3.5*	23.1	7.1

* Significant differences at the 5% level. Treatment means.

There was significant interaction (at the 5% level) between water depletion and percent efficiency for span and strength of the first pick and for strength of the second pick (at the 1% level). When 1^c and 2^c pick were combined significant interaction (at the 1% level) was found for strength for pick x depletion x efficiency. There was no significant interaction for the data of the trickle plots.

Irrigation efficiency treatments did not greatly affect quality of the fiber (Table 1). For the first harvest, the 50 percent efficiency treatment produced the highest lint percent and also the highest uniformity ratio. The 100 percent efficiency treatment resulted in the lowest micronaire (3.5) but the greatest strength (26.0). Quality of the cotton from the second harvest was reduced which is common, and does not reflect effects from irrigation treatments.

Fewer differences were noted at different levels of depletion (Table 2). The 75 percent depletion treatment resulted in a lower lint percent than the other treatments. This difference may have been a result in degree of seed development.

Greatest differences in cotton fiber quality were noted in plots irrigated by trickle irrigation (Table 3). The dry treatment (0.6 bars) resulted in significantly lower fiber than the wet treatment (0.2 bars). When both harvests are considered, three significant differences in the fiber properties were noted: (1) the dry treatment produced lower lint percent; (2) the dry treatment resulted in longer fibers; and (3) the dry treatment produced a lower micronaire reading. Only the greater fiber length would be beneficial to a cotton producer. The greater fiber length would have outweighed the reduction in micronaire and lint percent.

These results indicate that efficiently using soil moisture does not reduce fiber quality seriously. An excess of soil moisture is not necessary for production of good quality fiber.

Preparations were made for planting of cotton during the second half of April. All plots were preirrigated with 16 inches of water. The cotton will be planted on level soil, but this year a sand cap will be applied over the seed to prevent crusting of the surface soil over the seed.

2. Measure Water and Solute Flow

Saturation extracts were obtained on soil samples taken at two locations and at 20 cm depth intervals within each of the 33 plots. The samples were taken during the last two weeks of November and the first week of December. The electrical conductivity of the saturation extracts of each of these 264 samples was measured in the laboratory. The results were analyzed statistically and are presented in Tables 4 and 5.

Table 4. Treatment means of the electrical conductivity of the saturation extracts (mmhos/cm) of the surface plots.

Efficiency %	Depth (cm) 0-20	20-40	40-60	60-80	80-100	100-120	120-140	140-160	All Depths
50	1.69	2.54	4.48	4.95	4.95	3.61	2.55	1.69	3.31
75	1.90	3.16	5.30	5.43	5.42	3.59	3.06	2.89	3.85
100	1.93	3.17	5.11	5.32	4.27	2.94	2.32	2.18	3.40
Depletion									
25	2.25*	3.32	5.61	6.14	6.32**	4.44	3.22	2.55	4.23*
50	1.68*	2.67	4.86	4.81	4.29**	3.08	2.47	1.86	3.22*
75	1.58*	2.87	4.42	4.75	4.03**	2.61	2.25	2.35	3.11*
All Treatments	1.84**	2.95**	4.96**	5.23**	4.88**	3.38**	2.65**	2.25**	

* Significant differences at the 5% level.

** Significant differences at the 1% level.

Table 5. Treatment means of the electrical conductivity of the saturation extracts (mmhos/cm) of the trickle plots.

Tension atm	Depth (cm) 0-20	20-40	40-60	60-80	80-100	100-120	120-140	140-160	160-180	All Depths
0.2	2.71	2.03	2.07	2.06	2.19	1.72**	1.31*	1.31	.95	1.82
0.6	2.17	2.41	2.63	3.32	2.96	2.64**	2.00*	1.32	.91	2.26
Location										
Row	1.98	2.16	2.35	2.85	2.86	2.38	1.76	1.43	.99	2.08
Center	2.91	2.28	2.36	2.52	2.29	1.99	1.55	1.20	.87	2.00
All Treatments	2.44**	2.22**	2.35**	2.69**	2.58**	2.18**	1.66**	1.31**	.93**	

* Significant differences at the 5% level.

** Significant differences at the 1% level.

There was significant interaction (at the 5% level) between depths below the soil surface and percent depletion. There was significant interaction (at the 1% level) between depths below the soil surface and location and some interaction between tension, location, depth below the surface (at the 5% level).

Comparing the data in Tables 4 and 5 with the salinity data of the plots taken the previous spring (see Quarterly Report October, November, December, 1972), it appears that the differences in salinity before and after the 1972 growing season are small. The differences in salinity of the soil profiles in the surface irrigated plots and in the trickle plots (Tables 4 and 5) are quite obvious. However, these differences were existent before the start of treatments and cannot be attributed to the different irrigation management procedures.

It is somewhat surprising that for the trickle plots the differences between the salinity of the soil in the row and between the row were not larger. The electrical conductivity of the saturation extracts of the samples taken in between the rows near the soil surface is higher than in the row, as should be expected, but the difference is not significant (at the 5% level).

During the past year 30 salinity sensors installed in the soil around two trickle lines were monitored at regular intervals. The results obtained with the salinity sensors so far are rather encouraging. The sensors respond quite nicely to changes in soil salinity because of rainfall or irrigation. In order to be able to better measure the salt build up around trickle irrigation lines, 80 more salinity sensors were ordered. The 80 sensors will be added to the

30 salinity sensors already in the soil. The sensors will be installed such that a rectangular grid pattern is formed around each of two trickle lines in two plots (high and low efficiency, respectively). It is hoped that measurements of all salinity sensors can be started right after planting.

3. Determine Hydraulic Characteristics of Soil

All surface irrigated plots were flood irrigated with 16 inches of water and covered with plastic. For periods varying from three weeks to three months the drainage of these plots was measured with the neutron meter. The tensiometers were also read to determine the pressure gradients in the subsoil during drainage of these plots. The data will be used to estimate the hydraulic characteristics of the subsoil of each plot. Not enough time was available to make these measurements for the trickle plots.

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

Water samples were taken at weekly intervals from the wells and the Del Rio Drain and analyzed in the laboratory. One set of samples was taken from the suction cups from each plot. This set of samples is being analyzed completely for anions and cations.

5. Modify Irrigation Scheduling Program

Rather than using our own modified program for scheduling irrigation, a cooperative program was set up with the Bureau of Reclamation in El Paso. In this cooperative program we will do field measurement on water depletion and collect weather data at the site. The Bureau of Reclamation will feed our information into their computer program at El Paso and inform us when to irrigate the various treatments. This cooperative program allows us to use a program, with which the Bureau at El Paso has had very satisfactory results during the past year. On the other hand, it allows the Bureau to further test their program on cotton on well controlled field plots. We will also be measuring pan evaporation data as a control system in guiding our irrigation schedule.

7. Repair Tensiometers and Suction Cups

Tensiometers and suction cups were repaired and used during the last three months in determining the hydraulic gradients in the subsoil and in obtaining samples from the soil solution in the subsoil. Little or no damage was done to the tensiometers because of freezing conditions during the past winter.

8. Work for the Past Crop Year

Will be summarized in the annual report in July.

9. Data on Salt and Water Movement

Have been presented under Subject 2. Additional data will be presented in the annual report when data on the hydraulic properties of the soil are available.

10. Revisions in Project or Data Collection

As was indicated under Subject 5, irrigation scheduling will be done in cooperation with the Bureau of Reclamation at El Paso. The computer program used for the irrigation scheduling is essentially the one developed by Dr. Marvin Jensen at Idaho. Weather data will be collected at the experimental site on a weather station now being developed in cooperation with researchers from the Department of Agronomy, Agricultural Engineering and Botany and Entomology. Dial type tensiometers were received and will be installed in the middle row of surface irrigated plots after germination of the cotton at depths of 25 and 50 cm below the soil surface.